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What's Inside

Engineering to Be Deregulated

Tuition Expected to Increase to $5800

Karen Virk
ELEC 9T9

UofT is shortly expected to accept the Access to Opportunities Program offered by the government, which will allow it to deregulate engineering tuition. Although they have not formally accepted yet, all schools participating must accept before November 16 and Professor Sedra, Vice-President and Provost, stated that it is very likely the proposal will be accepted.

Deregulation will mean that universities will have the full power to set tuition in deregulated faculties. Presently, the government controls tuition increases for all regulated faculties and an increase beyond what the government stipulates is not possible. Part of the government proposal states that 30% of tuition increases for deregulated faculties must go towards financial aid for students.

Government funding for universities has reduced in recent years and universities have long been stating that more money is needed to maintain quality of education. Most universities have been rallying for deregulation for quite some time now, with UofT at the top of the list.

Last year UofT had an income of $976.7 million, 46.1% of that was from the government, research and other grants, 21.7% was from student fees, 4.6% was donations and 27.6% was from investment income. There was a $28.8 decrease from government, research and other grants and investment income is not expected to be as high this year. Many university officials see raising tuition as necessary to generate the needed additional income.

This year, Governing Council at UofT voted that tuition cannot increase more than 20% each year for the next two years. This means that for students currently enrolled, tuition can increase at the most 20% next year and 20% the year after. For domestic students, tuition this year was $3800 plus incidental fees.

Professor Sedra stated that ideally tuition for engineering would be $5000 plus incidental fees. First year students next year would have to pay the full amount, starting in September, but this would be in full effect for all students for the year 2000-2001.

This follows the recent deregulation of all other professional faculties including Law, Medicine, Pharmacy and Dentistry. Tuition for these faculties drastically increased this year. Medicine increased from $4800 to $11,000 for first year students. One reason engineering will not increase to that extent is because it is a direct entry program from high school.

Another major consideration is financial aid for the students. This year the university put into place a new Policy on Student Financial Support that states that "no student admitted to a program at the University should be unable to enter or complete the program due to lack of financial means."

The university will put aside $49 million a year to provide grants to students in need and that number will increase with the 30% of increases from engineering tuition. This money will go into the common pot for all students. Ian Orchard, Vice-Provost, Students, stated that there is no need for the money to go solely to engineering students because they are guaranteed to be able to attend university with this new policy.

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Growing Pains

Paul Leventis
Engineering Science 0T0

Have you noticed that engineering has been a little crowded lately? Well, it's not in your head, and thanks to upcoming enrollment increases under the Access to Opportunities Program (ATOP), it's going to get worse before it gets better.

ATOP is a new initiative launched by the Ontario Government during the May budget. It is designed to increase the number of students enrolled in high-demand programs. According to Dean Charles, these include Electrical and Computer Engineering, some options within Engineering Science, the Mechatronics option of Mechanical Engineering, and the new Information Engineering option within Industrial Engineering. Specifically, ATOP provides both one-time and on-going funding per student in these high-demand programs, and universities participating in ATOP will be able to deregulate tuition. However, in order to participate in ATOP, a university must double their 1995 enrollment figures for these high-demand fields by the year 2000.

After much consideration, the Faculty of Engineering has decided to participate in ATOP. In fact, back in 1995 the Faculty independently decided to double enrollment in Computer Engineering. As a result of this past action, as well as significant increases in the number of students in the Engineering Science program, meeting the enrollment requirements of ATOP will only require modest increases over current enrollment. For example, according to Prof. Zaky, Chair of the Department of Electrical and Computer Engineering, ECE will grow from a frosh class of 280 students this year to 320 students in the year 2000 – not a huge increase by any measure.

Essentially, our participation in ATOP will give the Faculty the resources it requires in order to fix some of the difficulties encountered due to enrollment increases that have already occurred.

This is not to say that the growth will come without problems. Dean Charles sees three main challenges; one major challenge is "growing the department, particularly ECE in terms of its faculty compliment, to provide not only undergraduate instruction, but also to provide direction of research on the Masters and Ph. D. levels." The Faculty is actively recruiting professors to meet the increased teaching demands. However, our school is not the only one looking to expand; the other Ontario engineering schools, as well as many of the large schools in the US, are also increasing enrollment in undergraduate high-technology programs. This, coupled with a lucrative job market, is making it difficult to attract enough faculty of the quality and caliber required by the Department of Electrical and Computer Engineering.

Another challenge on Dean Charles' list is to ensure that we have enough students available "keen to study at the University of Toronto, with academic qualifications that are roughly equivalent to those we currently admit."

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the Cannon

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PLEASE NOTE
The Cannon is a medium through which undergraduate engineering students can express their opinions. The views expressed herein are those of the author and do not necessarily represent those of the editors or the Engineering Society unless so indicated.

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Editorials & Opinions...

From the Editor
Arnold Choi

Don't Smoke Crack

The shot of the kids nodding their heods in obsolute, unifying ogreement wos whot stuck in my mind.

I was at the movies last night, watching Waterboy starring Adam Sandler with a friend. For those who don't have a clue what it's about, in short, it's about a football team whose waterboy becomes a star line-backer, and becomes the team's (and the city's) most beloved moron of all time.

There was one scene that stuck in my mind when I saw it, and it bothered me for some reason.

This particular joke, although one of many, wasn't funny at all. It went something like this: the waterboy, after being recognized as Louisiana's Mud Dog's greatest line-backer of all time, was invited to a football camp to speak to a bunch of dreamy-eyed kids hoping to make it to the NFL one day. The camp coach introduces the waterboy and asks: "Tell us how you do it? You always get your man! Tell us how you anticipate where your man is going to be on the field every single time?" The waterboy answers in his Adam-Sandler's-semi-intelligent-whiny-little-putz voice, "Well, the Centre has the ball before the game is called into play, then he passes it to the Quarter-Back. So I usually try to tackle him. Sometimes the Quarter-Back passes it to the Wide-Receiver, so then I try and tackle him."

Everyone, including the coach sort of looks at him in disbelief, unsure if this idiot was the real thing. "Well, this leads to my next topic," the coach continues. "Don't smoke crack." The camera turns to a shot of the kids, sitting, staring and nodding their heads in total, hypnotic agreement.

Ha ha ha!

"Don't smoke crack." "Yes master, we will not smoke crack." "Crack is bad." "Yes crack is bad." Without thinking and without realizing, this adage had become a mantra to which these kids had no choice but to listen to, agree and repeat. "Don't smoke crack." Three simple words. A command. A cliché. A joke. Originally, sometime in the mid 1980's, this anti-drug slogan/campaign made its way to mainstream North Americans because there was a tremendous movement in America to stop drug-use. Don't do drugs. Just say no. It was simple. It was easy. And it made sense. But after time, the words lost their meaning. Yet people believed in the words not because it was true, but because it became a fashionable thing to say. Why? How did this happen? Perhaps it was the simplicity of the slogan. It was too easy to say and not think about what it meant. Perhaps it was because it *wos* a slogan. In either case, you didn't need to question the motivation behind the campaign. Everyone was doing it, it must be right.

"Money doesn't grow on trees". "Clean your room".

It's frightening to see how simple phrases like that can change the way we think and the way we act. The kids in the movie had probably never seen crack before in their lives, or understood why drugs were "bad" for you, or even why society was holding them back from it. But their parents were telling them not too. And their friends were all singing the same song. So was the TV, and the radio and the Presidency. Even Michael Jordan. What they probably weren't told was that in hundreds of countries (and religions) in the world, smoking cannabis is considered to be a sacred and holy ceremony. Goodness! Could the rest of the world have fallen from grace? They must be evil, because we are good, and we don't do drugs. This self-created sense of ignorant enlightenment was the same sort of dogma that justified the european's "conversion" of South American savages to Christianity.

You don't have to look far to find more brainwashing proverb, and to see how blindly (subconsciously) we agree to so many of them. "Stay in school". "Get a job". "Change is good". Few people questions these anymore, and those who do, find themselves pushed up against a wall and flogged for not following the rest of the class. Why are you in school and why do you have to stay? Is there an inherent value in going to classes you have no in inherent interest in? Does going to school mean I'll be happy?If I get a job, does it mean I'll be successful? Why do I *need* to get a job? And why *doesn't* money grow on trees? It's so easy to say. It's so easy to agree. We rarely think about the implications and the entrapment of these slogans, and so rarely understand why we feel trapped by the iron grip of "society's" rules. Artsies suck. Engineers rule the world. "That's okay, you will work for us someday." It never ends.

Is it all a joke? I didn't think so at the theatres. Adam Sandler thought it was though. "Don't smoke crack". It's become such common place nowadays, that you can say it anywhere, anytime, and still be right. Is there an inherent truth behind the words? Perhaps if we just kept printing "The Cannon is the best student engineering newspaper in the world" people will eventually believe us. That'll save a lot of time.

Taken Verbatim

M. Jakubik
www.ecf.utoronto.ca/~choi/firstperson.htm

How much do we actually learn from lectures? A person who stands at the front of a class and repeats knowledge at which he is expert cannot communicate in simple terms. A professor who has studied a subject for years is unlikely to use language a class can understand. It is much easier to invent new terminology than to express technical concepts in terms of the everyday. Thus, in subjects such as physics, engineering, and even literature, we hear about facts in the abstract. The question is could we not learn more through the concrete?

So what is the concrete? What is learning? Knowledge is experience; that is, knowledge is not theory, but having done something. You do not 'know' for example, how to throw a baseball even if you have understood all the muscle movements that combine to form the pitch.

Likewise, you do not 'know' about Buddhism if all you have done is studied it in books, or lived among Buddhists. You only 'know' by having been a Buddhist, and if you try to substitute experience, then you postulate. Yet professors continue, and increasingly, to lecture to their classes, backs to the board and facing a passive sea of human tape recorders.

I come to expect the lecture format from math and computer classes. The concepts in those subjects have long ago moved far beyond anything a human being can comprehend. When we students are exposed to technical lectures, we of necessity understand a mere fraction of what the lecturer understands. This is likely because the lecturer never learns how to communicate the ideas to human beings, but only to those within his field. Nowadays, this practise is justified by the term 'jargon.' However, I am discouraged to find the same practise in my English classes. These are supposed to be arenas of the humane, where we discuss not the most modern of advances, but the ideas that historically led us to those advances. Yet, how effective can this be when our 'discussion' is but passive attendance.

These words: jargon; attendance; and theory, are all terms modern to education, and all serve to promote an attitude of inaction. The lecturer speaks, and we hear. Would we not learn more by active discussion? The problem is deceptively shallow. It seems as though all we need to do is to participate more. As if maybe it's our fault for not raising our hands enough. My statistics professor distresses every day how low participation is in his class. By the end of every lecture, he has repeated at least five times how awful he feels that we aren't answering his questions. On the first day of class, he made a significant statement. He said, 'I don't want to be the only one talking here. These lectures don't work if you don't participate.' Well-meaning, he understood that we will not learn statistics by formulae given verbatim.

He betrayed, however, his insecurity. His eyebrows were compressed, and he put on a tone of excessive sympathy, knowing that he needed our patience in the face of a statement that was all but ridiculous. Though there may be truth to what he meant, there is absolutely no example of open discussion in the mathematics faculty. Probably in no technical field in the world. The word technical was likely adopted in modern times to justify the type of environment where only one expert may

speak on a subject, and his audience, in the belief that the facts are black and white, must listen. But does this environment really exist? Can you really, truly ask no questions whatsoever about how gravity works? Can you not challenge that electric current is composed of electrons? Can you not doubt that 2 follows 1? What havoc would ensue if students sat in circles and challenged the teacher at every step! Imagine a world in which a professor could not finish Kubla Khan in a classroom because the students turned the pages the wrong way! What would ever become of engineering subjects if each equation were challenged variable by variable?! Why, we would get nowhere! No lecturer could hope to move through her advanced topic as quickly as she had in her research, for students would pose obstacles at all turns. In such a world, nobody would ever want to teach at all!

My statistics professor now continues to ask us for input, and he stands at the front of the class looking down upon us, giving us simpler and simpler questions until somebody finally breaks the deadly silence and answers something. Yet he can't hide his impatience when we ask questions that 'slow the course down.'

Professors pretend to he concerned that students will fall behind, yet they are more afraid that they will not spew out all their material. The rush is caused by the concept of 'finishing a course,' by which lecturers feel the pressure the material they must regurgitate. When we spend too much time challenging established dogma, we call it 'falling behind in lectures.'

Lectures often force an instructor to say 'we'll get to it later' in response to students' questions. They are inclined to do this because of the strict order imposed by a lecture-driven course structure. No less than negligent, this response completely ignores how the learning mind works. If an instructor would like to teach to an attentive audience, isn't a question a big, naked clue that the student is ready to take in a concept? When a student asks a question-especially these days when it is such a rarity-it means they are ready for that information now, not later, when the course outline declares that it must be taught year after year.

Recently I attended a workshop on study skills that also posed as a communal effort. Students were there to learn how to deal with exam preparation and homework management, and stress. Students were encouraged at the beginning to offer their own advice to their peers, because their familiarity with the pressures was closer than that of the graduate instructor. Yet, one of the first things the instructor said was that she was good at 'getting through these sessions fast.' Even a dummy could see that if she tried to get through the workshop quickly, students would have less time to offer advice.

Like in many classrooms, the 'student input' was limited to an occasional 'any questions?' or a quick tour around the room, where we were obligated to copy each others' responses to a leading question. My English professor raises his head to ask 'any questions' in a way that mocks the entire concept: he never pauses unless he's changing topics! The only class in which input is part of the curriculum is my public speaking workshop, where most of our time is spent learning to hold an audience's attention from behind a podium. Yet even though the lecturing is minimal, and the instructor vehemently proclaims how she hates to do it, the fold-out chairs in the room are nailed together in such a way as to prevent arranging them in a circle!

Perhaps the most disturbing trend in all this is the continual pretence that lecturers want our input. For some reason, teachers realize how much we're missing by sticking to the lecture format, yet the structure of learning makes it seem impossible to go any slower. It seems as though we'll learn nothing if we are allowed to discuss the subjects. But if academic communities are meant to graduate to applicators in society, how worthwhile is it to teach subjects so fast we can't possibly retain them beyond an exam? Is the illusion of speed not a sacrifice to actual knowledge? We are missing millions of new ideas that come from asking dumb questions about very simple concepts. With this approach, knowledge becomes sadly finite. It is only a matter of time before we learn everything there is to know and start looking around for someone to tell us what to do next

CUBE Corners Cleveland

Wilfred Lam
EngSci 0T0

All those gourmet lollipop sales have finally paid off. Last month, members of the Club for Undergraduate Biomedical Engineering (CUBE) drove down to Cleveland, Ohio to attend the annual fall meeting of the Biomedical Engineering Society (BMES). This trip, orchestrated by CUBE co-president, Mark Ebden, was both an informative and interesting event.

With support from the Institute for Biomedical and Biomaterials Engineering (IBBME) and the BMES, the group of seventeen CUBE members attended various presentations on Biomedical Imaging, Cardiovascular Mechanics & Devices (at which U of T's own Prof. Michael Sefton talked), Cellular & Biomedical Engineering, Neural Engineering and Tissue Engineering, just to name a few.

Imagine a CD studded with tiny channels used as mini-lab which not only functions as a centrifuge, but can also decant and mix as well! Computers are now used to monitor electroencephalograms (readings of the electricity from the skin surrounding the brain) 24 hours a day. Genetic algorithms, which simulate mutations and evolution, give us a reason why nerves are wired the way they are. Leading-edge nerve regeneration research may allow us one day to reconnect nerves with greater success. A keynote speaker told audiences of the popularity of minimally invasive surgery and how he sees it becoming as wide-spread as supermarkets!

Also at the conference was a career fair. Present were big biomedical device makers such as Boston Scientific and Medtronic (which will be at the CUBE Wine & Cheese on Nov. 10), that commanded long lines of students wanting to submit their resumes. The diamond sponsor of the event was Steris, which specializes in infection/contamination prevention.

To crown the event, a gala dinner was held at Cleveland's Rock and Roll Hall of Fame. At the awards ceremony, CUBE's own Roni Dattani and Mark Ebden were honoured in the undergraduate research and design category for their work in photodynamic therapy and brain mapping, respectively. Next year's conference in Atlanta promises to be even better since it will be held jointly with the IEEE.

For more information on CUBE, see http://www.ecf.utoronto.ca/~cube/
For more information on the IBBME, see http://www.ibme.utoronto.ca/

Deregulation

The procedure is as follows, OSAP provides a maximum of $9000 a year to a student in need and any need above that will be met by means of a grant from the university. For professional faculties, the need above OSAP will be met by means of up to a $2000 grant and "interest subsidy on the amount of loan required".

The university has arranged an "income-sensitive loan remission plan for profacs through Scotia Bank. According to an information update from the Office of the Vice-Provost, Students, this is designed to benefit graduates who "choose relatively low income careers within a high income profession" and "those who suffer from ill fortune during the early years of their career.

Despite these measures, many students are concerned that the idea of a large debt when graduating will still deter students from accepting admission to Professional Faculties. Many question whether or not the financial aid program is presently sufficient, and there is concern that it will not be able to handle the heftier tuition of newly deregulated faculties.

Among the current concerns with financial aid are the qualification requirements for OSAP and the timing for receiving the money. Students from lower middle-income families may be hit hard because they do not qualify for OSAP but cannot afford their education. This is a problem that Ian Orchard says that the university will be looking at in the future. In addition to that they will be looking at the timing issue because students receive grants and bursaries in November and only 60% of their OSAP in September.

Details of the deregulation policy for engineering students will be available once the university accepts the offer. Every engineering faculty in Ontario has accepted the offer except Queens and UofT, who are just putting together counter proposals. Both schools are expect to shortly say yes.

These issues along with the Access to Opportunities Program will be discussed at a Town Hall for ECE students Thursday November 5, at 12 to 1 or 1 to 2. For information concerning ATOP, please read the accompanying article by Paul Leventis. If you have any questions or concerns please come to the meeting or email virk@ecf.utoronto.ca.

Expansion

Many people have argued that by increasing enrollment, we must be decreasing the entrance standards. However, Dean Charles says that "we are very confident given the high demand that we have for Engineering Science and Computer Engineering that we will have no difficulty whatsoever attracting or recruiting the students we are accustomed to having." Prof. Zaky raised another good point on the quality of the student body: the additional funding provided by the government under ATOP will enahle the Faculty to improve undergraduate education. One specific example cited by Prof. Zaky is that with a larger pool of professors, the Department will have a broader coverage of the many fields of electrical and computer engineering. Indeed, Prof. Zaky hopes that though enrollment will increase, the quality of graduating students may increase as well.

The third challenge seen by Dean Charles is to make sure that we have the physical facilities necessary. ATOP provides the funds necessary to equip laboratories and hire staff, but it does not address the physical infrastructure problem. The current engineering buildings are already being stretched beyond their intended capacity. It is obvious that new facilities will be required to house the additional students. The Faculty is currently working hard to secure funding to add undergraduate teaching facilities to the Advanced Technology Research Facility, a project that was previously geared solely towards research. However, since a new building will not be ready until at least 2001, an interim solution is required. One possibility under review is the renting of space in off-campus facilities to temporarily handle the overload.

One resource that frequently seems to be overlooked is the availability of teaching assistants. ECE is already experiencing TA shortages, and some undergraduates have been hired to satisfy the demand. This problem will hopefully be solved through the planned expansion of graduate enrollment, complimenting the expansion of the student body and the faculty compliment. Indeed, according to hoth Prof. Zaky and Dean Charles, graduate students will be important not only as TAs for undergraduate courses, hut also to attract faculty since directing graduate research is one of the main responsibilities of a professor. To secure enough graduate students, the Faculty will be "proactively recruiting"; however, the joh market and competition from other schools are posing major challenges in attracting enough graduate students.

Both Prof. Zaky and Dean Charles see increased enrollment as a positive step for the Faculty. The ECE department is currently one of die top ten, if not top five, such programs in North America according to independent peer review. An increased faculty compliment will enahle us to maintain or advance our standing; indeed, as the fields of electrical and computer engineering continue to grow, additional staff are needed in order to ensure that broad coverage is maintained. In addition, with deregulation and a resulting "modest" increase in fees, the Faculty will be able to further improve the quality of undergraduate education. Please see the accompanying article *Engineering To Be Deregulated* on page 1 by Karen Virk for more on deregulation.

Whether we like it or not, increased enrollment is all but a done deal. The "doubling" of enrollment isn't as bad as it may seem; indeed, it appears that once the transition period is complete, the school environment will indeed he better for students than it is today. However, these transitory years will be difficult; hopefully through collaboration between Faculty and the student body, mutually acceptable solutions to the short-term problems can he found.

There will be two ECE town hall meetings on Novemher 5 at 12:00 and 1:00 p.m. respectively in the Fitzgerald Building, room 103, to discuss ATOP and its implications. If you would like further details on ATOP, please read the transcript and notes from my meetings with Dean Charles and Prof. Zaky at http://www.ecf.utoronto.ca/~leventi/ATOP.html.

Martin's Corner...

We're all students, and we all have midterms.

One of the epidemics of the midterm period is the spread of advice that goes to the tending and relief of exam anxiety. At this time, it is common to hear several times a day what is the best way to approach stress. Everything from campus posters to helpful professors to counselling workshops tells us how to deal with the burden of exams.

You may hear, as you proceed through this period, of various methods. Some sound like your mother talking: 'make sure you *eat right*,' '*get plenty of sleep*,' and 'avoid procrastination.'

Some suggestions are more realistic: get lots of exercise, go out to bars, or play the hell out of a bunch of drums or a guitar. I'd like to tell you about an increasingly popular alternative: go stick needles in your head.

Last summer, I began talking to a friend with back problems who regularly visited a chiropractor. I was feeling lethargic and stressed and was looking for something to do to fix that. My friend mentioned that his doctor could also perform acupuncture.

Acupunture, as the pamphlet informs, is piercing of the skin with a needle. The

treatment is an ancient Chinese technique which combats an ailment by aligning channels of energy in your body so that the body is better poised to fight the ailment itself. It has been practised in China for thousands of years and has produced charts of thousands of puncture points.

Many people avoid it because it sounds like a load of crap.

Channels of energy?! Do these really exist? Indeed, western medicine initially rejected the holistic theory of healing; western knowledge relies heavily on theoretical science, and that which cannot be measured is often avoided. However, in the past few decades, western medicine has recognized the accomplishments that eastern medicine has racked up over the centuries.

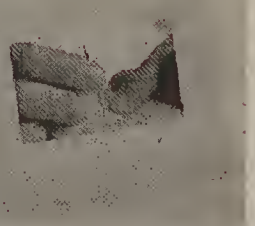
The needles actually work. My doctor treats many students at exam time, and they leave the office feeling a hundred times more relaxed than when they came in. More substantially, my grandmother took up acupuncture treatment for her migraines, and she was immensely relieved when it succeeded. One thing to remember about holistic medicine is that it is not a cure. The term 'holistic' refers to approaching the entire body as well as its current environment. It is more of a confidence boost that encourages your body to heal itself, rather than a surgical extraction of the pesky problem.

All I know is, when I lie there in the dark with seventeen needles in my back, I better *relax*, because I'm *not going to risk rolling* over and shoving those things into my spine.

Nowadays, acupuncture can even help those with a fear of needles. Not everybody likes the idea of metal objects stuck precariously in their epidermis. A modern technique involves a low electric current applied to the acupuncture points with a hand-held device. No piercing occurs, and the same 'blockage' is cleared to allow your energy to flow. It is a matter of taste: I like the luxury of lying in a dark room with a genuine excuse not to move a muscle, but the little electric device is painless and unobtrusive.

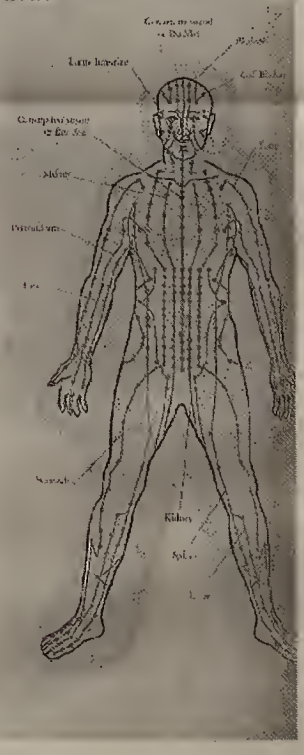
On that note, there are many other techniques in eastern medicine that employ the same holistic approach. There's acupressure, a type of massage; there's moxibustion and cupping, where heat is applied to special points on the body; and there's even um... ear coning, which is an attractive technique that deals with your earwax. Whatever is the most comfortable for you is the best place to start.

After about half and hour (15 minutes to prepare, and 15 to lie in the dark), I feel much better. This term, I scheduled my appointments on the days of the toughest exams. Perhaps you can even try it on days



when you get your exam marks back! All in all, one treatment is not too expensive, costing between $20-30. Some insurance plans may cover acupuncture, considering its effectiveness with migraines and general aches, although a relaxing chiropractor is actually recognized by OHIP. And it is not difficult to find a practitioner; you'll likely see many offices close to school, and a chiropractic office will carry brochures for many forms of holistic medicine.

And it does a body good. If you've ever been curious about acupuncture, now is a good time to try it. You could find yourself piercing through those midterms feeling as sharp as you did on the first day of term.



CN Tower Stair Climb

Pierre Duez
ENG SCI 0T0

It was a cold, bitter Monday in December, with snow three feet deep and still falling, when a handful of courageous Engineers gathered at the base of the 1,000-storey monolith, ready for a climb that would last several days, if not months. All were grim-faced as they stood prepared to accept whatever fate had in store for them. In the end, they knew, their survival was far from guaranteed...

Okay, so it wasn't quite like that. A bunch of Engineers went to the CN Tower the morning of October 19th (it was a fairly pleasant day) to climb the 1776 steps (roughly 100 storeys) of the world's tallest free-standing structure. There were a few veterans in the group – I, their leader was a four-time veteran of the climb. I also overslept that morning, putting us over an hour behind schedule. Others were new to the climb, and waited with a mixture of anticipation and fear as the time to climb drew near.

A universal "code red" on the stairs ground matters to a halt just as our intrepid climbers were about to commence their journey. As a result, we waited for about 20 minutes, quite literally first in line, as they helped victims of over-exertion onto the elevators. (Apparently, those things can stop every 20m or so.) In that time, we got to know the security guard at the base (he was quite friendly once he got over the fact that we had waaaay too much energy for a Sunday morning), as well as the people behind us. We even got in a couple of rounds of charades.

During this time, the BNAD arrived for their annual climb. Though they were not allowed to take their instruments with them in the stairs, they brought the crowd much joy (really!) with their usual repertoire of trumpets, bedpans, and kazoos. But we were only able to appreciate their presence for a short while, as the code red soon cleared and we were on our way up.

Once we arrived at the top, each at his own pace, we lingered for a while, enjoying the (warm) gale-force winds that were rocking the great Tower that day. A walk or two across the glass floor, then it was back down to ground level for breakfast, compliments of IGA.

And then we went away from that great building, that marvel of Engineering. As we left, the BNAD was still waiting patiently in line, with only a dozen or so climbers behind them. I understand that they did, indeed, eventually make their way to the top.

The CN Tower Stair Climb occurs twice a year: the climb in October is in support of the United Way. The other climb is in May, and is for the World Wildlife Fund

The BNAD's next engagement is at the Santa Claus Parade on Sunday November 15th.

Class Reps for the 1998/99 Skule™ Year

Dwayne Shirley
MMS0T0

Following an intense search for the best students this faculty has to offer, only the best of the best have been chosen. They are leaders, the brave and the proud (enough already). Okay, the students who represent each undergraduate engineering class on both the Engineering Society and Faculty Council have all been elected and sworn in to serve a one-year term.

These positions are vital to keeping students aware of the current events within Skule™ and for giving priority to their classes' points of view in various meetings on the student and administrative levels of U of T government.

The Engineering Society representative is responsible mainly for keeping his/her class abreast of events within the society, (a.k.a. checking the class mailbox) and otherwise promoting Skule™ spirit among classmates by organizing class socials. The Faculty Representative is responsible for attending all full Faculty Council meetings, collecting Professor Evaluation Comments, sitting on Faculty standing committees (strange, huh), assisting the Engineering Society representative and generally acting as a link between Professors and his/her class. The two representatives work as a team to serve their fellow classmates and promote an enhanced Engineering education experience.

A complete listing of your class representatives can be found on page 7.

APSC - FINAL EXAMINATION TIMETABLE

FALL 1998

D	AER301F	DYNAMICS	THU. DEC. 10,1998 - 2:00 P.M.
A	AER305F	FLUID MECHANICS	FRI. DEC. 18,1998 - 9:30 A.M.
D	AER373F	MECH.OF SOLIDS & STR.	TUE. DEC. 15,1998 - 9:30 A.M.
X	AER402F	ATMOSPHERIC FLIGHT	WED. DEC. 09,1998 - 9:30 A.M.
D	AER410F	GASDYNAMICS	MON. DEC. 14,1998 - 2:00 P.M.
X	AER506F	SPACE.DYN.& CONT.I	WED. DEC. 16,1998 - 2:00 P.M.
A	APM288F	ORD.DIFFER.EQUATIONS	TUE. DEC. 08,1998 - 2:00 P.M.
A	APM291F	DIFFERENT. EQUATIONS	TUE. DEC. 15,1998 - 2:00 P.M.
C	APM384F	PART.DIFFERENT.EQUA.	WED. DEC. 09,1998 - 9:30 A.M.
A	APS103F	ENG.SOCIETY & ENV.I	MON. DEC. 21,1998 - 9:30 A.M.
A	APS105F	COMPUTER FUNDAMENTAL	THU. DEC. 17,1998 - 9:30 A.M.
A	APS106F	FUNDAMENT.OF COMPUT.	THU. DEC. 17,1998 - 9:30 A.M.
X	APS107F	INTRO.TO COMP.FUND	THU. DEC. 17,1998 - 9:30 A.M.
D	APS185F	TECH.WRIT.IN ENGLISH	MON. DEC. 21,1998 - 2:00 P.M.
X	APS232F	ENTREPRE.& SMALL BUS	WED. DEC. 09,1998 - 2:00 P.M.
A	APS302F	ENG.SOCIETY & ENV.II	FRI. DEC. 11,1998 - 2:00 P.M.
A	BME495F	MOLECULAR &CELL.BIO.	THU. DEC. 17,1998 - 2:00 P.M.
C	BME595F	BIOMEDICAL IMAGING	TUE. DEC. 15,1998 - 9:30 A.M.
B	CHE112F	CHEMISTRY	THU. DEC. 17,1998 - 9:30 A.M.
A	CHE150F	CHEMISTRY	FRI. DEC. 11,1998 - 2:00 P.M.
B	CHE200F	APPLIED CHEMISTRY I	FRI. DEC. 11,1998 - 9:30 A.M.
A	CHE203F	APPLIED CHEMISTRY II	WED. DEC. 09,1998 - 9:30 A.M.
D	CHE211F	FLUID MECHANICS	TUE. DEC. 15,1998 - 9:30 A.M.
C	CHE221F	CAL.& NUM. METHODS	FRI. DEC. 18,1998 - 9:30 A.M.
C	CHE312F	MASS TRAN.FUNDAMENT.	WED. DEC. 09,1998 - 9:30 A.M.
C	CHE321F	APP.DIFFERENT.EQUAT.	TUE. DEC. 15,1998 - 9:30 A.M.
B	CHE331F	THERMODYNAMICS II	THU. DEC. 17,1998 - 2:00 P.M.
C	CHE332F	REACTION KINETICS	THU. DEC. 10,1998 - 9:30 A.M.
X	CHE349F	ENG. ECONOMIC ANAL.	MON. DEC. 14,1998 - 2:00 P.M.
C	CHE372F	CHEM. THERMODYNAMICS	WED. DEC. 16,1998 - 2:00 P.M.
A	CHE390F	PHYS.&INORGANIC CHEM	MON. DEC. 14,1998 - 2:00 P.M.
C	CHE393F	TRANSPORT PHENOMENA	MON. DEC. 21,1998 - 2:00 P.M.
C	CHE412F	ADV. REACTOR DESIGN	WED. DEC. 16,1998 - 2:00 P.M.
D	CHE463F	POLYMER SCI. & ENG.	FRI. DEC. 11,1998 - 2:00 P.M.
A	CHE466F	BIOPROCESS ENGINEER.	THU. DEC. 10,1998 - 9:30 A.M.
D	CHE468F	NUCLEAR ENGINEERING	THU. DEC. 17,1998 - 2:00 P.M.
D	CHE553F	ELECTROCHEMISTRY	TUE. DEC. 08,1998 - 2:00 P.M.
A	CIV101F	STRUCT.MAT.& DESIGN	MON. DEC. 14,1998 - 9:30 A.M.
D	CIV102F	STRUCT. & MATERIALS	MON. DEC. 21,1998 - 9:30 A.M.
C	CIV210F	SOLID MECHANICS I	MON. DEC. 21,1998 - 2:00 P.M.
A	CIV255F	SURVEYING	TUE. DEC. 15,1998 - 9:30 A.M.
C	CIV261F	ENGINEERING MATH.I	FRI. DEC. 11,1998 - 9:30 A.M.
D	CIV312F	STEEL& TIMBER DESIGN	FRI. DEC. 18,1998 - 2:00 P.M.
X	CIV314F	STRUCTURAL DESIGN	FRI. DEC. 18,1998 - 9:30 A.M.
A	CIV321F	GEOMECHANICS	THU. DEC. 17,1998 - 2:00 P.M.
C	CIV331F	TRANSPORT I - DESIGN	THU. DEC. 10,1998 - 2:00 P.M.
A	CIV358F	SURVEY CAMP	WED. DEC. 16,1998 - 9:30 A.M.
X	CIV362F	ENGINEERING MATH.II	WED. DEC. 09,1998 - 9:30 A.M.
B	CIV375F	BUILDING SCIENCE	MON. DEC. 14,1998 - 2:00 P.M.
D	CIV416F	REINF CONCRETE II	FRI. DEC. 11,1998 - 2:00 P.M.
C	CIV420F	CONSTRUCTION ENG	FRI. DEC. 18,1998 - 2:00 P.M.
A	CIV465F	AQEOUS POLL.& CONT.	TUE. DEC. 08,1998 - 2:00 P.M.
D	CIV514F	CONCRETE CONSTRUCT.	MON. DEC. 14,1998 - 9:30 A.M.
X	CIV519F	STRUCTURAL ANA. II	WED. DEC. 09,1998 - 2:00 P.M.
A	CIV524F	ROCK MECHANICS	THU. DEC. 17,1998 - 2:00 P.M.
A	CIV531F	TRANSPORT III-PLANN.	MON. DEC. 21,1998 - 2:00 P.M.
A	CIV540F	TREATMENT PROCESSES	TUE. DEC. 08,1998 - 2:00 P.M.
C	CIV550F	WATER RESOURCES ENG.	WED. DEC. 16,1998 - 2:00 P.M.
B	CIV575F	BUILDING SCIENCE	MON. DEC. 14,1998 - 2:00 P.M.
C	CSC180F	INT.TO COMP.PROGRAM.	MON. DEC. 14,1998 - 2:00 P.M.
C	CSC181F	INT.TO COMP.PROGRAM.	MON. DEC. 14,1998 - 2:00 P.M.
A	CSC326F	PROGRAMMIN.LANGUAGES	WED. DEC. 16,1998 - 2:00 P.M.
A	CSC442F	SOFTWARE ENGINEERING	FRI. DEC. 18,1998 - 9:30 A.M.
X	CSC470F	COMP.SYS.MODEL.& ANA	FRI. DEC. 11,1998 - 2:00 P.M.
A	ECE212F	CIRCUIT THEORY	FRI. DEC. 18,1998 - 2:00 P.M.
D	ECE241F	DIGITAL SYSTEMS	TUE. DEC. 08,1998 - 2:00 P.M.
C	ECE250F	ELECTRIC CIRCUITS	WED. DEC. 16,1998 - 2:00 P.M.
D	ECE253F	DIGITAL & COMPUT.SYS	FRI. DEC. 18,1998 - 2:00 P.M.
C	ECE302F	PROBABILITY & APPL.	FRI. DEC. 11,1998 - 2:00 P.M.
A	ECE310F	LINEAR SYSTEMS &COM.	WED. DEC. 09,1998 - 2:00 P.M.
A	ECE320F	FIELDS AND WAVES	FRI. DEC. 18,1998 - 9:30 A.M.
D	ECE330F	SEMICONDUCT. PHYSICS	MON. DEC. 21,1998 - 2:00 P.M.
D	ECE334F	DIGITAL ELECTRONICS	MON. DEC. 21,1998 - 2:00 P.M.
D	ECE341F	COMPUTER ORGANIZ.	MON. DEC. 14,1998 - 2:00 P.M.
C	ECE350F	PHYSICAL ELECTRONICS	WED. DEC. 16,1998 - 2:00 P.M.
D	ECE352F	COMPUTER ORGANIZAT.	MON. DEC. 21,1998 - 2:00 P.M.
A	ECE355F	SYST.& SIGNAL ANAL. I	THU. DEC. 10,1998 - 9:30 A.M.
C	ECE359F	INDUST. ELECTRONICS	MON. DEC. 21,1998 - 2:00 P.M.
C	ECE360F	ELECTRONICS	FRI. DEC. 18,1998 - 2:00 P.M.
D	ECE370F	INTRO.TO MICROPROCE.	THU. DEC. 10,1998 - 2:00 P.M.
D	ECE371F	ENG. ECONO. ANALYSIS	WED. DEC. 16,1998 - 2:00 P.M.
D	ECE373F	ELECT.SYS.ANAL.&DES.	MON. DEC. 14,1998 - 2:00 P.M.
C	ECE410F	CONTROL SYSTEMS	MON. DEC. 14,1998 - 9:30 A.M.
C	ECE413F	POWER SYSTEM ANAL.	FRI. DEC. 11,1998 - 2:00 P.M.
A	ECE416F	COMMUNICATION SYSTEM	TUE. DEC. 08,1998 - 9:30 A.M.
C	ECE424F	MICROWAVES	MON. DEC. 21,1998 - 2:00 P.M.
D	ECE426F	INTRO.TO OPTICAL ENG	THU. DEC. 10,1998 - 9:30 A.M.
A	ECE435F	DIGITAL ELECTRONICS	WED. DEC. 16,1998 - 9:30 A.M.
D	ECE443F	SYSTEM SOFTWARE	FRI. DEC. 18,1998 - 2:00 P.M.
A	ECE445F	BIOELECTRICITY	WED. DEC. 16,1998 - 2:00 P.M.
A	ECE446F	ELECTROACOUSTICS	WED. DEC. 09,1998 - 2:00 P.M.
D	ECE471F	INSTRUMENTATION DES.	FRI. DEC. 18,1998 - 2:00 P.M.
D	ECE512F	ANALOG FILTERS	MON. DEC. 21,1998 - 9:30 A.M.
C	ECE533F	INDUST.ELECTRONICS	THU. DEC. 17,1998 - 9:30 A.M.
A	ECE534F	INTEGRATED CIR.ENGN.	FRI. DEC. 11,1998 - 9:30 A.M.
C	ECE557F	SYSTEMS CONTROL	FRI. DEC. 18,1998 - 2:00 P.M.
A	EDV220F	APPLIED ECOLOGY	WED. DEC. 16,1998 - 9:30 A.M.
A	EDV360F	ENV.IMP.& RISK ASS.	MON. DEC. 21,1998 - 2:00 P.M.
A	ENG182F	EFFECT.TECH.WRITING	MON. DEC. 21,1998 - 9:30 A.M.
A	ENG284F	VARIETIES OF FICTION	MON. DEC. 21,1998 - 2:00 P.M.
A	FRE186F	NON-ARTS FRENCH I	MON. DEC. 21,1998 - 9:30 A.M.
A	GEO310F	HYDRO.EXPLOR.& REC.	WED. DEC. 09,1998 - 9:30 A.M.
A	GEO430F	ECOLOGICAL ENGINEER.	THU. DEC. 10,1998 - 2:00 P.M.
A	HPS284F	HIS.OF NOR.AMER.TECH	FRI. DEC. 11,1998 - 2:00 P.M.
B	JTC413F	HYDROMET.& AQU.PROC.	MON. DEC. 21,1998 - 2:00 P.M.
C	JVM209F	ENGINEERING MATERIAL	FRI. DEC. 18,1998 - 9:30 A.M.
A	MAT186F	CALCULUS I	FRI. DEC. 11,1998 - 9:30 A.M.
A	MAT188F	APP. LINEAR ALGEBRA	TUE. DEC. 08,1998 - 9:30 A.M.
A	MAT194F	CALCULUS I	TUE. DEC. 08,1998 - 2:00 P.M.
A	MAT196F	CALCULUS A	FRI. DEC. 11,1998 - 9:30 A.M.
A	MAT198F	LINEAR ALGEBRA	TUE. DEC. 08,1998 - 9:30 A.M.
A	MAT280F	CALCULUS	FRI. DEC. 18,1998 - 2:00 P.M.
A	MAT290F	ADV.ENGINEERING MATH	THU. DEC. 10,1998 - 2:00 P.M.
A	MAT291F	CALCULUS III	TUE. DEC. 15,1998 - 2:00 P.M.
A	MAT389F	COMPLEX ANALYSIS	TUE. DEC. 15,1998 - 9:30 A.M
X	MIE200F	DYNAMICS	WED. DEC. 09,1998 - 9:30 A.M.
B	MIE230F	ENGINEER. ANALYSIS I	MON. DEC. 21,1998 - 2:00 P.M.
C	MIE231F	PROB.& STAT.FOR ENG.	THU. DEC. 10,1998 - 2:00 P.M.
D	MIE240F	HUM.CENT.SYST.DESIGN	TUE. DEC. 15,1998 - 2:00 P.M.
A	MIE270F	FLUID MECHANICS I	TUE. DEC. 08,1998 - 2:00 P.M.
C	MIE301F	KINE.&DYNAM.OF MACH.	WED. DEC. 09,1998 - 9:30 A.M.
X	MIE310F	THERMODYNAMICS	WED. DEC. 16,1998 - 2:00 P.M.
D	MIE312F	FLUID MECHANICS I	THU. DEC. 10,1998 - 9:30 A.M.
C	MIE337F	STAT.& EXPER. DESIGN	WED. DEC. 09,1998 - 9:30 A.M.
B	MIE342F	CIRCUIT THEORY	WED. DEC. 09,1998 - 9:30 A.M.
D	MIE343F	INDUST.ERGO.& WORKPL	TUE. DEC. 15,1998 - 9:30 A.M.
A	MIE353F	DATA MODELLING	WED. DEC. 16,1998 - 2:00 P.M.
A	MIE358F	ENG.ECONO.& ACCOUNT.	THU. DEC. 10,1998 - 9:30 A.M.
C	MIE364F	MET.OF QUAL.CONT.IMP	FRI. DEC. 18,1998 - 2:00 P.M.
D	MIE371F	ENG. ECONOMIC ANAL.	FRI. DEC. 18,1998 - 9:30 A.M.
A	MIE372F	CONTROL SYSTEMS	WED. DEC. 16,1998 - 2:00 P.M.
D	MIE404F	CONTROL SYSTEMS I	TUE. DEC. 15,1998 - 9:30 A.M.
D	MIE414F	APP. FLUID MECHANICS	THU. DEC. 17,1998 - 9:30 A.M.
A	MIE440F	MECHANICAL DESIGN	WED. DEC. 09,1998 - 2:00 P.M.
A	MIE448F	COGNITIVE ERGONOMICS	MON. DEC. 14,1998 - 2:00 P.M.
A	MIE451F	DECISION SUPPORT SYS	WED. DEC. 09,1998 - 9:30 A.M.
C	MIE467F	ADV.OPERATIONAL RES.	FRI. DEC. 11,1998 - 2:00 P.M.
X	MIE536F	ENGINEER.ANALYSIS II	TUE. DEC. 08,1998 - 9:30 A.M.
C	MIE566F	DECISION ANALYSIS	WED. DEC. 16,1998 - 2:00 P.M.
A	MMS101F	APP.SCI.:MATERIALS	THU. DEC. 17,1998 - 2:00 P.M.
A	MMS150F	INT.MATERIALS SCIEN.	MON. DEC. 14,1998 - 9:30 A.M.
C	MMS202F	THERM.& PHASE EQUIL.	THU. DEC. 10,1998 - 2:00 P.M.
A	MMS207F	STRUCT.&CHAR.OF MAT.	TUE. DEC. 08,1998 - 2:00 P.M.
C	MMS270F	MATERIALS SCIENCE	FRI. DEC. 18,1998 - 9:30 A.M.
A	MMS313F	HIGH TEMP.PHYS.CHEM.	MON. DEC. 14,1998 - 2:00 P.M.
C	MMS314F	KINETICS OF MAT.PRO.	WED. DEC. 09,1998 - 9:30 A.M.
A	MMS315F	ENVIR.DEGRAD.OF MAT.	WED. DEC. 16,1998 - 9:30 A.M.
A	MMS316F	MECH.BEHAV.OF MATER.	FRI. DEC. 11,1998 - 2:00 P.M.
A	MMS401F	MATER.SELECT.&DESIGN	THU. DEC. 17,1998 - 2:00 P.M.
C	MMS402F	SOLIDIFICA.& CASTING	THU. DEC. 10,1998 - 2:00 P.M.
A	MMS420F	BIOMATERIALS	TUE. DEC. 08,1998 - 2:00 P.M.
A	MMS450F	PLANT DES.PROC.IND.	TUE. DEC. 08,1998 - 9:30 A.M.
C	PHY180F	PHYSICS I-MECHANICS	THU. DEC. 17,1998 - 2:00 P.M.
A	PHY280F	PHYSICS II	THU. DEC. 10,1998 - 2:00 P.M.

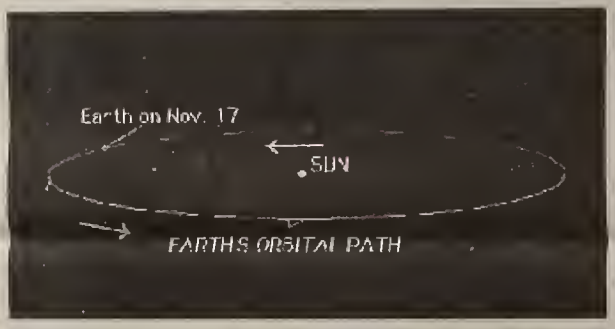
News External

Desperately Seeking Leonids

Ivan Semeniuk

The astronomical spectacle of a lifetime? Maybe. But if you don't have your tickets booked for Ulan Bator, or some other East Asian locale, your personal rendezvous with the 1998 Leonid meteor shower could be more of an understated affair.

That doesn't mean it's not worth going out to look for meteors on the nights of November 16th and 17th, but for Canadian observers the event is more likely to be a normal Leonid shower than the big meteor storm astronomers are predicting for the eastern hemisphere. The reason has everything to do with timing. On November 17, at 2:00 p.m. EST, the moment Earth is projected to encounter the greatest number of Leonid meteors, North America is facing



nearly opposite the planet's motion through space. So as the world drives into what could be its biggest meteor storm since 1966, most Canadians will be looking out the "rear window" at a bright, blue daytime sky.

At first pass the Leonids make an unlikely candidate for a spectacular storm. Most years they put on a lackluster show, providing about 15 meteors per hour under ideal conditions—a mere quarter the number typically seen during the annual Perseid shower every August 11. The Leonids can improve dramatically however about every 32-34 years, when Comet Tempel-Tuttle swings through the inner solar system. Leonid meteors originate as fine dust particles which are blown off the comet's surface and cut across Earth's orbital path. While Earth intersects this particle stream every year, always around November 17, the stream is particularly dense around the time the comet is passing near the sun. That's when the low meteor rate of normal Leonid shower can suddenly rise to staggering levels - by some accounts up to 150,000 an hour, as happened in 1966, the last time the Leonids roared. Comet Tempel-Tuttle's most recent appearance occurred about 10 months ago, leading many astronomers to predict that this year's Leonids should not be missed.

Historical records indicate that the Leonids also made a big impression in 1799 and 1833. Because of the path Earth is taking through the Leonid stream this year, experts don't expect anything quite so dramatic. Instead computer simulations predict a more modest, but still very active storm over East Asia on November 17th, perhaps approaching rates of 1000 meteors per hour, similar to the Leonid storm of 1866. It may not be the biggest ever, but that's enough of a storm to send Canadian meteor researchers traipsing across the Gobi desert in hopes of learning something new about how meteor streams work. Meanwhile, a team of NASA scientists will fly an airborne meteor mission out of Japan.

What does all of this mean to backyard stargazers hoping to see a few extra Leonids this year? According to the International Meteor Organization, Canadian observers can only expect to see a slightly better than average Leonid shower. The best time to watch will be just before dawn on November 17th, when 20 - 40 meteors per hour might be observed under ideal conditions. Because of times zones this window occurs slightly closer to the peak of the storm in the western part of the country, so British Columbians will probably see more meteors than east coasters that day. The situation is reversed the following morning, on November 18, when the Leonid count should be around 10 to 20 meteors per hour, this time with the Atlantic side of the country favoured.

In general, the Leonids are best when the constellation Leo is highest in the sky. Although there is no direct connection between the meteors and the stars of Leo, the meteors always appear to radiate from the direction of that constellation, just like snowflakes appear to radiate from a point in the road ahead when your driving through a snow flurry at night.

In general, no matter when they are observed, Leonids have one thing going for them: speed. Because Comet Tempel-Tuttle orbits the sun in the opposite direction the Earth does, we meet the Leonid head on with an impact velocity that is a combination of our motion, and the incoming particles' motion through space. As a result, Leonids hit the atmosphere moving at 71 kilometers per second. This high speed ensures Leonid meteors burn up quickly and brightly, with a higher proportion of brilliant fireballs than many other showers.

One other big advantage for meteor watchers this year is the new moon, which means the sky will be good and dark throughout the night.

If you are planning to go out and observe the Leonids this year remember to dress warmly and arrange your observing location ahead of time. Ideally you want a dark, open area far from city lights. The only good way to observe meteors is on your back, either on a blanket or a deck chair that lets you lie horizontally. Once your eyes are adapted to the darkness, meteors should appear as bright points of light streaking across the sky over a matter of seconds. Sometimes it seems like a long wait between meteors, which is why many observers bring music to listen to, or better yet, a fellow observer to converse with.

There is one part of Canada where observers may potentially see the storm activity scientists will be looking for in Asia. At arctic latitudes, at least above 68 degrees north the sky will be in perpetual twilight, with Leo just above the northwestern horizon at the critical moment.

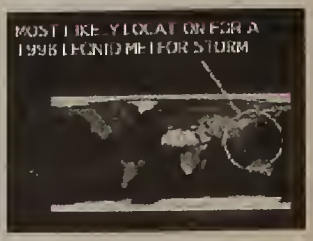
If that's not good enough, astronomers say next year may bring another Leonid storm, this time over Europe. Unfortunately the moon will also be up to detract from the view. Meanwhile it's worth remember that predictions are only predictions. The only way to know that the Leonids are really going to do this year is to go out and have a look.

Good luck!

For more information on observing the Leonids visit the International Meteor Organization site http://www.imo.net/news/ . Sky & Telescope magazine also has a good meteor site http://www.skypub.com/sights/meteors/meteors.html For more information on what scientists hope to learn from the shower, try the Leonid Storm Page at NASA's Ames Research Center.

More sky-highlights

November is prime viewing time for Queen Cassiopeia, the W-shaped constellation that is a celestial favourite among beginners and seasoned astronomers alike. While it resembles a letter of the alphabet to most North Americans, the zigzag outline of Cassiopeia reminded ancient Greeks of a royal throne upon which sat the vain Ethiopian queen, mother of



Andromeda.

Now it appears, the ancient Greeks were not the only storytellers to look to Cassiopeia for inspiration. In the current issue of Sky & Telescope magazine, physicist Donald Olson, his wife, English professor Marilynn Olson and physicist Russell Doescher argue that an exploding star that appeared in the Cassiopeia in 1572 may have found it's way into Shakespeare's "Hamlet".

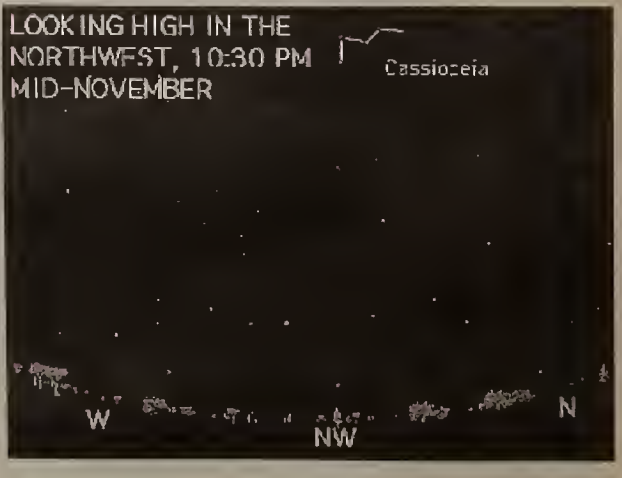
The stellar explosion, generally called Tycho's Supernova, after the famous Danish astronomer who studied it, would have been widely seen across Europe. Shakespeare himself was eight years old at the time, and may have been influenced by witnessing what would have seemed a miraculous event.

A key passage near the beginning of Hamlet mentions "yon same star that's westward from the pole", the location where we find Cassiopeia in November.

This is not the first time Shakespeare's astronomical references have been linked to real astronomical events of the day, but of course no one can really prove the Bard had a supernova in mind when he penned his masterwork. Nevertheless, it's an opportunity to gaze at a familiar constellation and remember that humans have always been storytellers, skywatchers and often both at once.

About the star maps

All maps were created using Starry Night Deluxe, by Sienna Software.



How Do I get a P.Eng?

Johnny Zuccon
PEO

1) Get an Engineering Degree from an accredited Faculty of Engineering. (For example: UofT)

2) Apply to PEO for a EIT (Engineer In Training. This used to be known as a GEIT, Graduate Engineer In Training.) The cost is $50+ GST on top of the application fees ($175 +GST) The EIT fee is renewed annually until you become licensed.

3) Get experience. In Ontario you need 4 years of practical experience after graduation to become a Professional Engineer. PEO is debating allowing undergraduate experience, such as PEY (Professional Experience Year) to count as 1 of the 4 required years. PEO Council has not been able to convince the Attorney General that PEY should be counted. PEO is also trying to convince the Attorney General that the Experience requirement should be 3 years. The Attorney General is reluctant to do so, since the last PEO council had the experience requirement raised to 4 years from the previous 2.

4) Write the Professional Practice Exam (PPE). The PPE covers Ethics and Engineering Law. The cost of writing the PPE is $100. There is a lot of material to study from. PEO recommends 2 text books to study from: Professional Engineering Practice and Ethics, Andrews and Kemper, 2nd Edition; and Law for Professional Engineers, Marston, 3rd edition. PEO also provides old exam reprints. There is also a study manual and video that was developed in partner with Waterloo Professor Andrews. U of T also offers courses in Ethics.

5) Apply to PEO for P.Eng. The application fee (mentioned above) is $175+GST. The application asks about your experience and education. It is sent to the Experience Review Committee for approval. It is also sent to the Academics Committee to review your education. If you graduated from an accredited Faculty of Engineering, (Such as the Ontario Universities) you will be quickly approved. If you graduated from outside Canada, the Academics Committee must review all the courses of study at that University to determine if you have enough knowledge.

This done, you get licensed to call yourself a Professional Engineer, stamp and sign drawings and much more.

The Annual renewal dues for a P.Eng licensee is $130 +GST.

PEO Student Initiative

Johnny Zuccon
PEO

Last May PEO Council met to create the Student Task Force. Their mandate is to investigate the subject of student membership. No Report has been given to Council yet. How Do I get My Certificate of Authorization? The following is Correspondence with John Zuccon P.Eng, PEO Staff.

What's the C o A?

The C o A is a license that allows "individuals and business entities to offer and provide professional engineering services to the public, as distinct from a P. Eng., license issued to individuals to practice professional engineering." It is covered in section 12(2) if the Professional Engineers Act. The requirements are covered under section 47(1) of the Regulations (941). The initial application cost is $250 + GST, and the license is an additional $250 + GST. It is renewed annually ($250 + GST).

When can you get a C o A?

Under section 47(1) of Regulation 941, a Certificate of Authorization (C o A) can be sought provided the "applicant for a C o A designate a P.Eng., who is an employee or partner in the firm to assume responsibility for the services provided. The P. Eng. must have at least five (5) years of professional engineering experience following the conferral of a degree from an accredited university or the completion of an equivalent education."

How soon after getting a P.Eng can you do consulting work?

If one plans to do professional engineering independently (i.e. not working for say Hydro) then one must get a C o A. The type of work provided through the C o A, may be considered consulting. So the information above on the C of A question applies. However, one cannot hold oneself out as a "Consulting Engineer" unless he has been granted this permission through PEO. "Consulting Engineer" is a reserved title/designation. Individuals seeking such designation must apply to PEO. The cost is $150 + GST (re-designation occurs every five (5) years). The individual needs to have been licensed as a P.Eng. for at least five years before applying. Furthermore, the individual must have been listed on a C o A for at least two years. References must be provided. It is not an additional license.

Listing of 1998/99 Engineering & Faculty Class Representatives

Compiled by the Engineering Society (October 26, 1998)

First Year

Frosh Group A	N/A	Paul Graham
Frosh Group B	Katherine Tattersall	Mark Juggassar
Frosh Group C	Maithili Mavinkurve	Adam Walker
Frosh Group D	Nader Muesetif	Jeremy Koudelka
Frosh Group F	Saba Amini	Fiona Fung
Frosh Group G	Somen Mondal	Charles Chen
Frosh Group Ny 1	Stephanie Pereira	Ashley Morton
Frosh Group Ny 2	Andre Mercanzini	Magdalena Wierus

Second Year

Chemical Engineering	Lorraine Rodrigues	Cynthia Hayward
Civil Engineering	Michael Iammarino	Adrian Deluca
Computer Engineering	Sherif Hanna	Philip Ng
Electrical Engineering	Geoff Masotti	Anna Cheung
Engineering Science	Felisa Zhang	Daniel Nephin
Industrial Engineering	Vinaz Verma	Vinder Sodhi
Materials Engineering	Vyassadev Munidas	Erin Oathwaite
Mineral Engineering	N/A	Melissa Nowicki
Mechanical Engineering	Renny Lam	Patrick Leong

Third Year

Chemical Engineering	Farid Haque	Julie Han
Civil Engineering	Yuval Grinspan	Leslie Ferguson
Computer Engineering	N/A	Kenneth McNeil
Electrical Engineering	Andrew Coultes	N/A
Engineering Science	Paul Leventis	N/A
Industrial Engineering	Marta Guardado-Redondo	Kate Law
Materials Engineering	Dwayne Shirley	Mike Yakimchuk
Mineral Engineering	Dan Rolph	Thomas Beaman
Mechanical Engineering	Sean-Paul Voskamp	Andy Sundarajan

Fourth Year

Chemical Engineering	Wai-Ming Lau	Said Yossof
Civil Engineering	Michelle Nokken	N/A
Computer Engineering	Patrick Doyle	Kedaar Ghanekar
Electrical Engineering	Zaheera Rosli	Jeremy Edwards
Engineering Science	N/A	N/A
Industrial Engineering	Pasquale Cosentino	Carl Woo
Materials Engineering	Geeta Bhadauria	Geeta Bhadauria
Mineral Engineering	Teresa Huang	Olga Kosarewicz
Mechanical Engineering	Steven Ekstein	Andy Sundarajan

Prime targets

Jay Ingram

Can the brain process information without our conscious awareness? According to a recent study (1) published in the scientific joumal NATURE, your brain may actually be paying close attention to what's going on around you —even if you don't think you are.

In this study, French researcher Stanislas Dehaene and his colleagues presented subjects with a visual display, as demonstated here. In less than a second, subjects were presented first with a MASK (a string of nonsense letters), then what's called a PRIME (a number between 1 and 9), another nonsense MASK, and finally a TARGET (a second number between 1 and 9). Subjects were asked to pay attention to the TARGET number. If the TARGET was larger than 5, they were asked to press a key with one hand. If the TARGET was less than 5, they were asked to press a key with the other hand.

It's important to note that the PRIME flashed up on the screen so quickly (43 thousandths of a second) that subjects couldn't tell whether it was there or not. They only saw a bunch of nonsense letter strings (MASKS) followed by the TARGET. In fact, they were completely unaware that each TARGET was preceded by a masked PRIME. On some trials, the prime and the target were both either smaller or larger than 5). On other trials, the PRIME was incongruent with the TARGET (i.e., one number was smaller than five and one number was larger than 5).

By recording the subjects' reaction times, the researchers found that subjects took longer to judge whether the TARGET was greater than five or less than five on incongruent trials compared to congruent trials. This suggests that the PRIME influenced the subjects' judgements (i.e., the brain was paying attention to the prime) — even though the subjects were not consciously aware of it.

How can we explain these results? Even if the subjects were not consciously aware of the PRIME, the researchers proposed that subjects may unconsciously apply the task instructions to it (i.e., categorize it as smaller than larger than 5) and would then prepare to move a hand to respond to the PRIME. But during incongruent trials, this covert response would mismatch with the overt response required for the TARGET. As a result, reaction times would be slower in the incongruent trials compared to the congruent trials because subjects would have to use the other hand to correctly respond to the TARGET.

To test this hypothesis, the researchers placed electrodes on the subjects' scalps over the motor cortex (the hrain region that is responsible for movement) and recorded electrical activity in the subjects' brains while they performed this task. If the researchers' theory were correct, then they should be able to detect activation in the motor cortex on the correct response side during congruent trials and activation on the incorrect response side during the incongruent trials —before an actual overt response is made. The results supported their hypothesis: PRIMES that were incongruent induced a brain activity over the "wrong" side of the brain before the subjects actually responded to the TARGET.

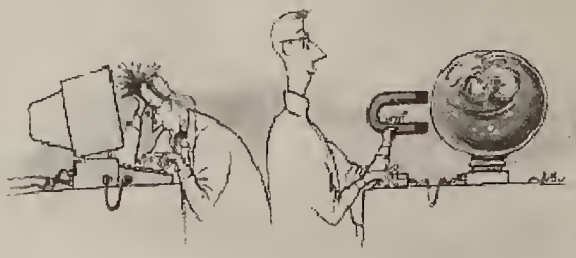
Even though recording electrical activity from scalp electrodes doesn't indicate the precise location of brain activity, the researchers confirmed their findings using magnetic resonance imaging. So this study demonstrates convincingly that the hrain processes information that we are not consciously aware of. What it doesn't tell us is how, when, or why the hrain can do this. How much information does the hrain process without our conscious awareness? Does this mean that we all know things that we don't know that we know? Could we one day somehow gain access to that "missing" information. And if we could, would we be disappointed with it? All good questions ... all questions without answers.

(1) Nature (1998). 395, 597-600.

Quantum Computing with Molecules

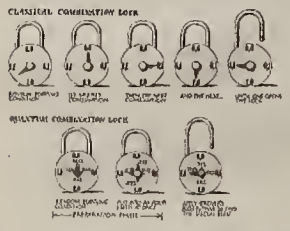
By taking advantage of nuclear magnetic resonance, scientists can coax the molecules in some ordinary liquids to serve as an extraordinary type of computer

Neil Gershenfeld and Isaac L. Chuang



Factoring a number with 400 digits—a numerical feat needed to break some security codes—would take even the fastest supercomputer in existence billions of years. But a newly conceived type of computer, one that exploits quantum-mechanical interactions, might complete the task in a year or so, thereby defeating many of the most sophisticated encryption schemes in use. Sensitive data are safe for the time being, because no one has been able to build a practical quantum computer. But researchers have now demonstrated the feasibility of this approach. Such a computer would look nothing like the machine that sits on your desk; surprisingly, it might resemble the cup of coffee at its side.

We and several other research groups believe quantum computers based on the molecules in a liquid might one day overcome many of the limits facing conventional computers. Roadblocks to improving conventional computers will ultimately arise from the fundamental physical bounds to miniaturization (for example, because transistors and electrical wiring cannot be made slimmer than the width of an atom). Or they may come about for practical reasons—most likely because the facilities for fabricating still more powerful microchips will become *prohibitively expensive. Yet the magic of* quantum mechanics might solve both these problems.



The advantage of quantum computers arises from the way they encode a bit, the fundamental unit of information. The state of a bit in a classical digital computer is specified by one number, 0 or 1. An n-bit binary word in a typical computer is accordingly described by a string of n zeros and ones. A quantum bit, called a qubit, might be represented by an atom in one of two different states, which can also be denoted as 0 or 1. Two qubits, like two classical bits, can attain four different well-defined states (0 and 0, 0 and 1, 1 and 0, or 1 and 1).

But unlike classical bits, qubits can exist simultaneously as 0 and 1, with the probability for each state given by a numerical coefficient. Describing a two-qubit quantum computer thus requires four coefficients. In general, n qubits demand 2n numbers, which rapidly becomes a sizable set for larger values of n. For example, if n equals 50, about 1015 numbers are required to describe all the probabilities for all the possible states of the quantum machine—a number that exceeds the capacity of the largest conventional computer. A quantum computer promises to be immensely powerful because it can be in multiple states at once—a phenomenon called superposition—and because it can act on all its possible states simultaneously. Thus, a quantum computer could naturally perform myriad operations in parallel, using only a single processing unit.

Action at a Distance

Another property of qubits is even more bizarre—and useful. Imagine a physical process that emits two photons (packets of light), one to the left and the other to the right, with the two photons having opposite orientations (polarizations) for their oscillating electrical fields. Until detected, the polarization of each of the photons is indeterminate. As noted by Albert Einstein and others early in the century, at the instant a person measures the polarization for one photon, the state of the other polarization becomes immediately fixed—no matter how far away it is. Such instantaneous action at a distance is curious indeed. This phenomenon allows quantum systems to develop a spooky connection, a so-called entanglement, that effectively serves to wire together the qubits in a quantum computer. This same property allowed Anton Zeilinger and his colleagues at the University of Innsbruck in Austria to perform a remarkable demonstration of quantum teleportation last year.

In 1994 Peter W. Shor of AT&T deduced how to take advantage of entanglement and superposition to find the prime factors of an integer. He found that a quantum computer could, in principle, accomplish this task much faster than the best classical calculator ever could. His discovery had an enormous impact. Suddenly, the security of encryption systems that depend on the difficulty of factoring large numbers became suspect. And because so many financial transactions are currently guarded with such encryption schemes, Shor's result sent tremors through a cornerstone of the world's electronic economy.

Certainly no one had imagined that such a breakthrough would come from outside the disciplines of computer science or number theory. So Shor's algorithm prompted computer scientists to begin learning about quantum mechanics, and it sparked physicists to start dabbling in computer science.

Spin Doctoring

The researchers contemplating Shor's discovery all understood that building a useful quantum computer was going to be fiendishly difficult. The problem is that almost any interaction a quantum system has with its environment—say, an atom colliding with another atom or a stray photon—constitutes a measurement. The superposition of quantum-mechanical states then collapses into a single very definite state—the one that is detected by an observer. This phenomenon, known as decoherence, makes further quantum calculation impossible. Thus, the inner workings of a quantum computer must somehow be separated from its surroundings to maintain coherence. But they must also be accessible so that calculations can be loaded, executed and read out.

Prior work, including elegant experiments by Christopher R. Monroe and David J. Wineland of the National Institute of Standards and Technology and by H. Jeff Kimble of the California Institute of Technology, attempted to solve this problem by carefully isolating the quantum-mechanical heart of their computers. For example, magnetic fields can trap a few charged particles, which can then be cooled into pure quantum states. But even such heroic experimental efforts have demonstrated only rudimentary quantum operations, because these novel devices involve only a few bits and because they lose coherence very quickly.

Desktop Quantum Computer

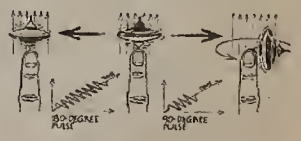
So how then can a quantum-mechanical computer ever be exploited if it needs to be so well isolated from its surroundings? Last year we realized that an ordinary liquid could perform all the steps in a quantum computation: loading in an initial condition, applying logical operations to entangled superpositions and reading out the final result. Along with another group at Harvard University and the Massachusetts Institute of Technology, we found that nuclear magnetic resonance (NMR) techniques (similar to the methods used for magnetic resonance imaging, or MRI) could manipulate quantum information in what appear to be classical fluids.

It turns out that filling a test tube with a liquid made up of appropriate molecules—that is, using a huge number of individual quantum computers instead of just one—neatly addresses the problem of decoherence. By representing each qubit with a vast collection of molecules, one can afford to let measurements interact with a few of them. In fact, chemists, who have used NMR for decades to study complicated molecules, have been doing quantum computing all along without realizing it.

Nuclear magnetic resonance operates on quantum particles in the atomic nuclei within the molecules of the fluid. Particles with "spin" act like tiny bar magnets and will line up with an externally applied magnetic field. Two alternative alignments (parallel or antiparallel to the external field) correspond to two quantum states with different energies, which naturally constitute a qubit. One might suppose that the parallel spin corresponds to the number 1 and the antiparallel spin to the number 0. The parallel spin has lower energy than the antiparallel spin, by an amount that depends on the strength of the externally applied magnetic field. Normally, opposing spins are present in equal numbers in a fluid. But the applied field favors the creation of parallel spins, so a tiny imbalance between the two states ensues. This minute excess, perhaps just one in a million nuclei, is measured during an NMR experiment.

In addition to this fixed magnetic backdrop, NMR procedures also utilize varying electromagnetic fields. By applying an oscillating field of just the right frequency (determined by the magnitude of the fixed field and the intrinsic properties of the particle involved), certain spins can be made to flip between states. This feature allows the nuclear spins to be redirected at will.

For instance, protons (hydrogen nuclei) placed within a fixed magnetic field of 10 tesla can be induced to change direction by a magnetic field that oscillates at about 400 megahertz—that is, at radio frequencies. While turned on, usually only for a few millionths of a second, such radio waves will rotate the nuclear spins about the direction of the oscillating field, which is typically arranged to lie at right angles to the fixed field. If the oscillating radio-frequency pulse lasts just long enough to rotate the spins by 180 degrees, the excess of magnetic nuclei previously aligned in parallel with the fixed field will now point in



the opposite, antiparallel direction. A pulse of half that duration would leave the particles with an equal probability of being aligned parallel or antiparallel.

In quantum-mechanical terms, the spins would be in both states, 0 and 1, simultaneously. The usual classical rendition of this situation pictures the particle's spin axis pointing at 90 degrees to the fixed magnetic field. Then, like a child's top that is canted far from the vertical force of gravity, the spin axis of the particle itself rotates, or precesses, about the magnetic field, looping around with a characteristic frequency. In doing so, it emits a feeble radio signal, which the NMR apparatus can detect.

In fact, the particles in an NMR experiment feel more than just the applied fields, because each tiny atomic nucleus influences the magnetic field in its vicinity. In a liquid, the constant motion of the molecules relative to one another evens out most of these local magnetic ripples. But one magnetic nucleus can affect another in the same molecule when it disturbs the electrons orbiting around them both.

Rather than being a problem, this interaction within a molecule proves quite useful. It allows a logic "gate," the basic unit of a computation, to be readily constructed using two nuclear spins. For our two-spin experiments, we used chloroform ($CHCl_3$). We were interested in taking advantage of the interaction between

the spins of the hydrogen and carbon nuclei. Because the nucleus of common carbon, carbon 12, has no spin, we used chloroform containing carbon with one extra neutron, which imparts an overall spin to it.

Suppose the spin of the hydrogen is directed either up or down, parallel or antiparallel to a vertically applied magnetic field, whereas the spin of the carbon is arranged so that it definitely points up, parallel to this fixed magnetic field. A properly designed radio-frequency pulse can rotate the carbon's spin downward into the horizontal plane. The carbon nucleus will then precess about the vertical, with a speed of rotation that depends on whether the hydrogen nucleus in that molecule also happens to be parallel to the applied field. After a certain short time, the carbon will point either in one direction or exactly the opposite, depending on whether the spin of the neighboring hydrogen was up or down. At that instant, we apply another radio-frequency pulse to rotate the carbon nucleus another 90 degrees. That maneuver then flips the carbon nucleus into the down position if the adjacent hydrogen was up or into the up position if the hydrogen was down.

Magnetic Nucleus

This set of operations corresponds to what electrical engineers call an exclusive-OR logic gate, something that is perhaps better termed a controlled-NOT gate (because the state of one input controls whether the signal presented at the other input is inverted at the output). Whereas classical computers require similar two-input gates as well as simpler one-input NOT gates in their construction, a group of researchers showed in 1995 that quantum computations can indeed be performed by means of rotations applied to individual spins and controlled-NOT gates. In fact, this type of quantum logic gate is far more versatile than its classical equivalent, because the spins on which it is based can be in superpositions of up and down states. Quantum computation can therefore operate simultaneously on a combination of seemingly incompatible inputs.

Two Things at Once

In 1996 we set out with Mark G. Kubinec of the University of California at Berkeley to build a modest two-bit quantum-mechanical computer made from a thimbleful of chloroform. Preparing the input for even this two-bit device requires considerable effort. A series of radio-frequency pulses must transform the countless nuclei in the experimental liquid into a collection that has its excess spins arranged just right. Then these qubits must be sequentially modified. In contrast to the hits in a conventional electronic computer, which migrate in an orderly way through arrays of logic gates as the calculation proceeds, these qubits do not go anywhere. Instead the logic gates are brought to them using various NMR manipulations. In essence, the program to be executed is compiled into a series of radio-frequency pulses.

The first computation we accomplished that exercised the unique abilities of quantum-mechanical computing followed an ingenious search algorithm devised by Lov K. Grover of Bell Laboratories. A typical computer searching for a desired item that is lost somewhere in a database of n items would take, on average, about n/2 tries to find it. Amazingly, Grover's quantum search can pinpoint the desired item in roughly tries. As an example of this savings, we demonstrated that our two-qubit quantum computer could find a marked item hidden in a list of four possibilities in a single step. The classical solution to this problem is akin to opening a two-bit padlock by guessing: one would be unlikely to find the right combination on the first attempt. In fact, the classical method of solution would require, on average, between two and three tries.

A basic limitation of the chloroform computer is clearly its small number of qubits. The number of qubits could be expanded, but n could be no larger than the number of atoms in the molecule employed. With existing NMR equipment, the biggest quantum computers one can construct would have only about 10 qubits (because at room temperature the strength of the desired signal decreases rapidly as the number of magnetic nuclei in the molecule increases). Special NMR instrumentation designed around a suitable molecule could conceivably extend that number by a factor of three or four. But to create still larger computers, other techniques, such as optical pumping, would be needed to "cool" the spins. That is, the light from a suitable laser could help align the nuclei as effectively as removing the thermal motion of the molecules—but without actually freezing the liquid and ruining its ability to maintain long coherence times.

So larger quantum computers might be built. But how fast would they be? The effective cycle time of a quantum computer is determined by the slowest rate at which the spins flip around. This rate is, in turn, dictated by the interactions between spins and typically ranges from hundreds of cycles a second to a few cycles a second. Although running only a handful of clock cycles each second might seem awfully sluggish compared with the megahertz speed of conventional computers, a quantum computer with enough qubits would achieve such massive quantum parallelism that it would still factor a 400-digit number in about a year.

Controlled-Not Logic Gate

Given such promise, we have thought a great deal about how such a quantum computer could be physically constructed. Finding molecules with enough atoms is not a problem. The frustration is that as the size of a molecule increases, the interactions between the most distant spins eventually become too weak to use for logic gates. Yet all is not lost. Seth Lloyd of M.I.T. has shown that powerful quantum computers could, in principle, be built even if each atom interacts with only a few of its nearest neighbors, much like today's parallel computers. This kind of quantum computer might be made of long hydrocarbon molecules, also using NMR techniques. The spins in the many atomic nuclei, which are linked into long chains, would then serve as the qubits.

Another barrier to practical NMR computation is coherence. Rotating nuclei in a fluid will, like synchronized swimmers robbed of proper cues, begin to lose coherence after an interval of a few seconds to a few minutes. The longest coherence times for fluids, compared with the characteristic cycle times, suggest that about 1,000 operations could be performed while still preserving quantum coherence. Fortunately, it is possible to extend this limit by adding extra qubits to correct for quantum errors.

Although classical computers use extra bits to detect and correct errors, many experts were surprised when Shor and others showed that the same can be done quantum-mechanically. They had naively expected that quantum error correction would require measuring the state of the system and hence wrecking its quantum coherence. It turns out, however, that quantum errors can be corrected within the computer without the operator ever having to read the erroneous state.

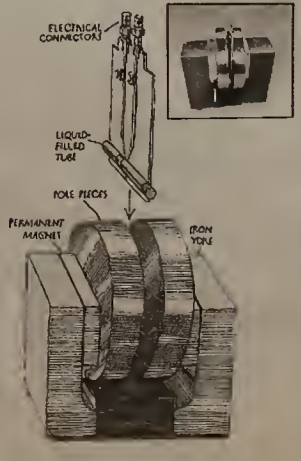
Still, reaching sizes that make quantum computers large enough to compete with the fastest classical computers will be especially difficult. But we believe the challenge is well worth taking on. Quantum computers, even modest ones, will provide superb natural laboratories in which to study the principles of quantum mechanics. With these devices, researchers will be able to investigate other quantum systems that are of fundamental interest simply by running the appropriate program.

Cracking a Combination

Ironically, such quantum computers may help scientists and engineers solve the problems they encounter when they try to design conventional microchips with exceedingly small transistors, which behave quantum-mechanically when reduced in size to their limits.

Classical computers have great difficulty solving such problems of quantum mechanics. But quantum computers might do so easily. It was this possibility that inspired the late Richard Feynman of Caltech to ponder early on whether quantum computers could actually be built.

Perhaps the most satisfying aspect is the realization that constructing such quantum computers will not require the fabrication of tiny circuits of atomic scale or any other sophisticated advance in nanotechnology. Indeed, nature has already completed the hardest part of the process by assembling the basic components. All along, ordinary molecules have known how to do a remarkable kind of computation. People were just not asking them the right questions.



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The Authors

NEIL GERSHENFELD and ISAAC L. CHUANG have worked together on problems of quantum computing since 1996. Gershenfeld first studied physics at Swarthmore College and Bell Laboratories. He went on to graduate school at Cornell University, where he obtained a doctorate in applied physics in 1990. Now a professor at the Massachusetts Institute of Technology, Gershenfeld also serves as director of the physics and media group of the institute's renowned Media Lab. Chuang studied at M.I.T. and at Stanford University, where he obtained a Ph.D. in 1997. He now studies quantum computation as a research staff member at the IBM Almaden Research Center in San Jose, Calif.

UofT Day a Great Success

Pierre Duez
ENG SCI 0T0

This year's Engineering Open House was a successful venture, according to the High School Liaison office. All Engineering departments and divisions showed their best colours as prospective students and their families toured the Engineering Buildings on October 3rd. Approximately 200 high school students who had registered for the Discovery Tours were given special tours of Engineering, stopping in at several presentations put on by each of the Engineering disciplines. These students also got special speeches from Engineering students on academic and social life within Engineering, as well as on the subject of PEY. Most high school students showed interest in learning about the selection process by which students are chosen for Engineering; this is traditionally an important topic among OAC students.

Though attendance was healthy this year, it was not at its all-time peak. A combination of an early UofT Day and a late start to the academic year (Labour day was on September 8th) meant that high-schools did not have as much time as in previous years to publicize the event to their students. Nevertheless, there were many inquisitive young minds present for a variety of interesting displays. Volunteers were on hand throughout the day to assist guests and answer their questions.

PEY & Careers

How To Screw Up An Interview

We've all heen interviewed for jobs. And, we've all spent most of those interviews thinking about what not to do. Don't bite your nails. Don't fidget. Don't interrupt. Don't belch. If we did any of the don'ts, we knew we'd disqualify ourselves instantly. But some job applicants go light years beyond this. We surveyed top personnel executives of 100 major American corporations and asked for stories of unusual bchavior by job applicants. The lowlights:

1. "... stretched out on the floor to fill out the job application."

4. "... asked to see interviewer's resume to see if the personnel executive was qualified to judge the candidate."

5. "... announced she hadn't had lunch and proceeded to eat a hamhurger and french fries in the interviewer's office - wiping the ketchup on her sleeve"

6. "Stated that, if he were hired, he would demonstrate his loyalty by having the corporate logo tattooed on his forearm."

10. "... pulled out a Polaroid camera and snapped a flash picture of me. Said he collected photos of everyone who interviewed him."

11. "Said he wasn't interested because the position paid too much."

13. "During the interview, an alarm clock went off from the candidate's brief case. He took it out, shut it off, apologized and said he had to leave for another interview."

14. "A telephone call came in for the job applicant. It was from his wife. His side of the conversation went like this: "Which company? When do I start? What's the salary?" I said, "I assume you're not interested in conducting the interview any Further." He promptly responded, "I am as long as you'll pay me more."
"I didn't hire him, but later found out there was no other job offer. It was a scam to get a higher offer."

16. "Candidate said he really didn't want to get a job, but the unemployment office needed proof that he was looking for one."

18. "Pointing to a hlack case he carried into my office, he said that if he was not hired, the bomb would go off. Disbelieving, I hegan to state why he would never he hired and that I was going to call the police. He then reached down to the case, flipped a switch and ran. No one was injured, hut I did need to get a new desk."

Industry Interview: MediaServ Information Architects

MediaServ is a rapidly growing development and IT consulting firm located in the heart of Manhattan with branches in Toronto, New Jersey and Chicago. Established in 1991, MediaServ is committed to providing products, services and knowledge that enable anyone to communicate anywhere and anytime. MediaServ solves complex information requirements with products and solutions that integrate seamlessly into corporate NT/ BackOffice infrastructures. They develop highly transactional and scalable e-commerce websites. Their clients are Fortune 100 companies, who represent the entertainment, multimedia, financial, engineering, telecommunications and utility, and fashion industries. As an Enterprise Solutions Provider and creator of interactive multimedia titles they have won several industry awards for outstanding technical achievements. MediaServ has been a premier Microsoft Partner since 1994.

The Cannon staff interviewed MediaServ to get a better sense of the company culture and the opportunities available to U of T engineering students considering a PEY or full-time position with this firm.

Describe your firm and the type of work performed:

We provide real-world solutions in the rapidly evolving market through the use of leading edge software and tools. We conduct knowledge exchange and provide online training services for Fortune 100 companies. Our typical customer is an organization that is interested in implementing an Enterprise Workflow framework with seamless interfaces to the Internet and messaging systems.

Describe your organizational structure:

FLAT! We offer all members of our staff above average responsibility, direct client interaction, the opportunity to excel in a dynamic development environment, and the chance to travel. We seek the brightest and best individuals in the industry to invest in for the long haul. We are looking for a variety of individuals to work in our solution teams. Our developers are innovative, self-starting individuals who take ownership of projects from conception to delivery. Our project teams are usually made up of three to five people. At Bell Mobility we have 10 people working on various projects.

Discuss the type of people that you hire and the lifestyle aspects of a career with your firm:

People are, without a doubt, MediaServ's most valuable assets. Our people are intelligent and have lots of personality. Our employees are diverse- coming from all corners of the world and our interests are as diverse as our collective heritages. We write novels. We pilot small aircraft. We trampoline. We tour in successful music groups. We snowboard when it's cold and rollerblade when it's not. We tend to be obsessive vegetarians or die-hard carnivores. Some of us read poetry on Friday nights while others continue in their determined daily pursuits of exploring, defining and shocking the city nightlife. We play hard but we are also known for our irreproachable work ethic. We are professional, prompt, knowledgeable professionals who learn what we don't know quickly and are gurus and demigods of what we do best. We expect the best-and we get it. It's one of the founding tenants of our success.

What types of changes are planned for the next few years in terms of service and growth?

We are growing. For example, this January our Toronto office started with 15 people and now we are at 30 and intend to hire many more new graduates and co-op/ PEY candidates. We are also expanding into Chicago and San Francisco. We are headquartered in New York City with branches in Toronto, New Jersey, and Chicago.

Describe the training programs or ongoing professional development programs for young professionals.

Mediaserv is a Microsoft Solutions Provider Partner. Our staff has the opportunity to attend many Microsoft conferences. Because we are so closely associated with Microsoft we learn new software and technology before anyone else. There is also a two-week knowledge exchange program for new hires. Because we are a consulting firm two days of every month are allocated to training. We are a company that will invest in skills-development of our staff. We offer our staff the opportunity to progress based on their initiative and accomplishments rather than by their seniority.

We are made up of people who are willing to buy into the fast-paced, high-reward work environment that pretty much sums up what MediaServ is about.

For more information check out our website at www.mediaserv.com or email lucyp@mediaserv.com.

MediaServ will be posting opportunities for PEY candidates and graduating students.

Writers needed!

We require students to conduct interviews with members of industry and write articles for the Careers/ PEY section of the Cannon. This is a great opportunity to develop contacts in business and skills communicating with potential employers. If you are interested please contact the Engineering Career Office.

Phone: 946-3730/Email: career@ecf.utoronto.ca

Understanding Cross-Cultural Differences For Working In Asia

Evelyn Man

It has been said that the 21st century will be 'the Asian century.' Asia has a quarter of the world's population and its economy has been steadily growing. It is a huge consumer market and many of its businesses have only recently embraced technology. It is a land that offers plentiful job opportunities, good pay and excellent promotion prospects for graduates educated abroad. Working in a foreign country offers excitement and challenge for young people. An understanding of cross-cultural issues will better prepare them for working in different language and cultural backgrounds.

When going through advertisements for jobs in Asia, do not be surprised if you find that items like age, gender, marital status or date of birth are included. Some companies even ask for your photograph. While such practice may not be acceptable in North America, it is quite common in Asia and is not regarded as any form of discrimination.

When writing resumes for Asian employers, do not be shy about emphasizing educational achievements. State any scholarships you hold - scholastic achievement is definitely an asset. If the company you apply to does a lot of business with countries like China, resumes can sometimes be submitted in Chinese as well.

Where the tone and style of your resume is concerned, western resumes stress achievements and adopt a more aggressive approach. In the Asian context, a resume that sounds too aggressive and has a high sales pitch may come across as being hollow and insincere. Some Asian companies may prefer traditional oriental values such as humility, modesty, and not too much 'blowing your horn.' So it may be a good idea to do some homework beforehand to find out what kind of background and management style a particular company prefers and then design the resume accordingly.

In job interviews, it would be quite common to be interviewed in more than one language. In places like Hong Kong, being interviewed in English, Cantonese and Mandarin is common. While eye-to-eye contact between interviewer and interviewee used to be regarded as inappropriate in some Asian contexts, that is largely no longer the case now.

Traditional Chinese values stress harmony rather than confrontation, collectivism rather than individualism. Employers therefore prefer candidates who can work in harmony in a team. A person who is highly individualistic and insists on his or her opinions may not be the ideal candidate in an Asian work environment. Where there is conflict between management and labour, Asians tend to avoid a confrontational style and would go for a more conciliatory approach to resolve disputes. A harmonious work environment is highly valued. Organizational goals are also often more important than individual goals.

The Chinese have a saying 'sacrifice the little self for the big self,' meaning that individual goals should be sacrificed for bigger goals such as organizational goals. That may be one reason why there are relatively fewer strikes in Asia compared to North America, because insisting on higher wages and better conditions for the individual at the expense of the organization is not acceptable. If the company suffers as a result of individual action, the individual is also at fault. Asian companies in general tend to be more organization-oriented than individual-oriented.

The Chinese revere their elders and attitude to superiors sometimes reflect that. Chinese companies are sometimes run by families with the elders in control, and traditional authority is not to be challenged. Organizational structures also tend to be more hierarchical and formal, with employees more conscious of their ranks than their western counterparts, who enjoy greater equality and democracy. Another cross-cultural difference is that agreements between parties in a western culture are usually put in writing, but Asians sometimes rely on verbal agreements based on trust, again reflecting a different culture.

However, we must be careful not to stereotype when we talk of people or practices from the east and the west. We now live in a global village and multinational companies have employees from all parts of the world. Many Asian employers are also well educated, well travelled, and familiar with western ideas and values. We need to strive for a greater understanding of cross-cultural issues to ensure maximum productivity. Irrespective of one's cultural background though, qualities such as responsibility, industriousness, motivation, resourcefulness and willingness to work and learn will always be attributes highly valued by employers wherever they are.

Evelyn Man is an academic who specialises in Asian work practices. This article is printed with the permission of CACEE.

What Does It Take to Be an Admired Company and Why Should You Care?

Wet Feet Press · The Information Source for Job Seekers
http://www.wetfeet.com · (800) 926-4JOB

You've had jobs before. Maybe you started out as a newspaper carrier in junior high, graduated to dishwasher in high school, and found yourself leading campus tours in college. Every one of those work atmospheres was different. As a newspaper carrier, no one bothered you--you had the streets to yourself at 5:30 in the morning—but first you had to wake up at 5:00 a.m. As a dishwasher, you got to eat with the crew after work—but you made minimum wage and had to spend your Saturday nights in a hot kitchen. As a campus tour leader, you met a wide range of prospective college students and their parents, worked with minimum supervision, and made a bunch of friends. These were small perks, but they made the job worthwhile.

When you graduate and move on, it's basically the same—you get some fringe benefits with any job. Maybe (say, at Web TV) you get free Odwallas; maybe (say, at Intel) you get subsidized meals; maybe (say, at the Advisory Board Company) you get happy hours every payday. All these things are well and good. They give you something small to look forward to, perks that increase the quality of your life. God, as they say, is in the details, and memorable managers know what details will make employees love their work, and workplace, the most.

But being an admired company isn't simply an issue of management; it's an organizational issue. And that's important for job seekers. Today's booming economy doesn't just mean that you can land a good job at good pay. It means you can land a good job at good pay at a good company. And you should really think about that when selecting a job. When you're working a 70-hour week as a management consultant, you don't have time for much of a social life. But some firms actively help you make a social life. At Deloitte & Touche, for instance, they have hobby clubs, so that workers can pursue common interests in their free time. DLJ offers cooking classes for all those who can't remember what their kitchens look like. Citibank has several famous "downstairs offices"—which serve drinks and hors d'oeuvres after six. You're still working, but it sure is nicer than the cubicles upstairs.

What makes an admired company? A recent *Fortune* article offers some ideas. Basically, it comes down to caring for employees. Admired companies let their workers know that they care about them. They hire people who work hard. They encourage employees to grow by offering training opportunities. They provide employees with well-articulated goals, and give them room to be leaders and reach those goals. They reward employees who do a good job. And they spend time trying to figure out whether or not their workforce is happy, soliciting feedback about the jobs their workers do, and adapting accordingly.

When you apply for a job, don't just apply for a job. Apply for a lifestyle. Find out if others at the company admire the company. What do they like? What don't they like? See if you can't track down some people who left. Ask them why they left. Was it the organization? Or did they want to do something different? How do they remember their experience? An admired company is a company that both present and former employees admire.

Good luck with your job search from your friends at WetFeet.com.

Visit www.wetfeet.com 24 hours a day to research a variety of industries. Check out free company profiles and preview our *Insider Guide* series.

The Extern Program and Career Development

INVEST A WEEK OF YOUR TIME TO EXPLORE YOUR FUTURE

Have you started to think about your career options? Do you have a few ideas, and want to explore them? Or, are you almost certain of your career path, and just want to confirm your choice.

If the answer is "yes" to any of these questions, Extern might be the program for you.

Extern is a unique career exploration program for University of Toronto students. The Career Centre offers students the opportunity to investigate their career interests in the actual workplace over a 1 to 5 day voluntary placement.

You will be matched with a sponsor by our office, and the Extern Placement activities may include:

- Shadowing your sponsor and other staff in their daily routines
- Interviewing your sponsor and staff members
- Attending meetings
- Touring other departments within the organization

Your first steps in the Extern program are choosing a career area to explore, filling out an application form and writing your resume. Attending a Discovering Your Skills and Options workshop can help you begin your career planning. To develop an effective resume, attend a Resume and Covering Letter workshop, and have your Resume critiqued in the Resume Clinic. Every Extern applicant is interviewed by a staff member, and then placed with a sponsor in their chosen career field. The insight and knowledge you can gain during your placement can be invaluable to your career development.

Do I qualify for Extern??

The Extern program is open to all current students taking at least one course during the winter term. You should be in your second year of studies or higher.

You may participate in Extern during Reading Week and/or immediately following final exams in May. Pick up an application form at the Career Centre.

Session 1: Feb 15—19, 1999
Application Deadline: October 30th, 1998

Session Two: May 10—14, 1999
Application Deadline: February 26th, 1998

Welcome to the Second Year of the Alumni Mentorship Program!

Take advantage of this opportunity to meet with leading engineering alumni who can provide you with essential information on the engineering programs, the employment market and tips for getting challenging employment. This is a wonderful opportunity to develop a relationship with an alumnus who has already gone through Skule ™ and survived. We hope you enjoy meeting with today's engineering leaders, speaking about current engineering issues, and hearing about how the "real world" works from someone who has "been there, done that".

ALUMNI MENTORSHIP PROGRAM GUIDELINES:

We stress that your mentor has no responsibility for finding you employment. They are available only to provide you with information.

You may ask your mentor what to expect from your first job and for insight into current industry trends.

Discussion may revolve around building a list of contacts in a particular industry.

Your mentor may tell you of negative experiences because information on what to avoid is also very useful.

You may ask your mentor to elaborate on their career path: "How did you get to where you are today?"

You may want to discuss the type of skills and experience employers are looking for, what will make you more marketable and the type of summer employment to pursue.

You may ask your mentor to outline an effective approach in interviews and have them relate experiences that have helped them obtain employment.

You may ask questions that are not career related; you may ask for your mentor's opinion on course selection, professors, and how to manage your academic careers.

STUDENT RESPONSIBILITY IN THE PROCESS:

1. Fill in the Student Application Form. Submit it to the Engineering Career Office. (Note: You must have an online resume to apply online. To get one, visit the Engineering Career Office site.) Alternatively, you can apply in person at the Engineering Career Office - bring a resume.

2. We will contact you within several days with a list of mentors for which you choose.

3. The mentor will contact you within 14 days of receipt your Student Application Form. It is your responsibility to ensure that the mentor is able to reach you. (email, answering machine,...)

4. During first contact, make sure you ask and understand how you may contact the mentor in the future.

5. It is your responsibility to propose topics of discussion and to forward them along to your mentor prior to your meeting.

6. If you meet over a meal, don't forget to pay for your half. There is no such thing as a free lunch or dinner!

7. This program is designed to provide students with a mentor to guide and help them by discussing topics of interest to both the student and the mentor. It is not intended to provide the students with future employment. For this reason, we ask you not to solicit employment from the mentor. Solicitation of employment will result in the student's immediate dismissal from the program.

8. You must be cognizant that the mentor has a personal and professional life. For this reason we ask you to contact mentors only at the specified contact information supplied to you. Intrusion into the life of the mentor will result in immediate dismissal from the program.

STUDENT TERMS AND CONDITIONS

This program is designed to provide students with a mentor to guide and help them by discussing topics of interest to both the student and the mentor. It is not intended to provide the students with future employment. For this reason, we ask the students not to solicit employment from the mentor. Solicitation of employment will result in the student's immediate dismissal from the program.

The student must be cognizant that the mentor has a personal and professional life. For this reason we ask the student to contact mentors only at the specified contact information supplied to them. Intrusion in the life of the mentor will result in the student's immediate dismissal from the program. We hope that this will be a rewarding experience for you. Please contact us at 416-946-3730 or career@ecf.utoronto.ca if you have any questions, comments, or suggestions.

Apply Now!

Upcoming Employer Information Sessions For Engineering Candidates

Wednesday, November 11
6pm to 8 p.m., Rotman School of Management
Gennum Corporation
Electrical/ Computer/ Mechanical Engineering

Thursday, November 19
6:30 p.m. - 8:30 p.m.
Galbraith Building, Room 202
Stemer Automation
Computer/Electrical/Mechanical Engineering

**Please pre-register in the Engineering Career Office or the MBA Career Management Centre

Schedule of Events

November

10 Tuesday

How to Identify Work Opportunities Workshop
1:00 p.m. - 4:00 p.m., Career Centre Seminar Room

Resume and Covering Letter Seminar
5:30 p.m. - 8:00 p.m., Career Centre Seminar Room

11 Wednesday

Graduating Students Employment Orientation
10:00 a.m., Career Centre Seminar Room

Interview Techniques Workshop
1:00 p.m. - 4:00 p.m., Career Centre Seminar Room

12 Thursday

Recent Graduates Employment Orientation
10:00 a.m., Career Centre Seminar Room

Discovering Your Skills and Options Workshop
1:00 p.m. - 4:00 p.m., Career Centre Seminar Room

16 Monday

Graduating Students Employment Orientation
10:00 a.m., Career Centre Seminar Room

17 Tuesday

Learn How to Approach Employers Workshop
10:00 a.m. - 1:00 p.m., Career Centre Seminar Room

Graduating Students Employment Orientation
2:00 p.m., Career Centre Seminar Room

Recent Graduates Employment Orientation
6:00 p.m., Career Centre Seminar Room

19 Thursday

Resume and Covering Letter Seminar
10:00 a.m. - 12:30 p.m., Career Centre Seminar Room

Discovering Your Skills and Options Workshop
1:00 p.m. - 4:00 p.m., Career Centre Seminar Room

20 Friday

Recent Graduates Employment Orientation
11:00 a.m., Career Centre Seminar Room

21 Saturday

How to Identify Work Opportunities Workshop
10:00 a.m. - 1:00 p.m., Career Centre Seminar Room

23 Monday

How to Look for Summer Work Seminar
10:00 a.m. - 12:00 p.m., Career Centre Seminar Room

24 Tuesday

Graduating Students Employment Orientation
10:00 a.m., Career Centre Seminar Room

Resume and Covering Letter Seminar
1:00 p.m. - 3:30 p.m., Career Centre Seminar Room

Interview Techniques Workshop
5:30 p.m. - 8:00 p.m., Career Centre Seminar Room

25 Wednesday

Recent Graduates Employment Orientation
10:00 a.m., Career Centre Seminar Room

Discovering Your Skills and Options Workshop
1:00 p.m. - 4:00 p.m., Career Centre Seminar Room

26 Thursday

Learn How to Approach Employers Workshop
1:00 p.m. - 4:00 p.m., Career Centre Seminar Room

27 Friday

Graduating Students Employment Orientation
11:00 a.m., Career Centre Seminar Room

30 Monday

How to Identify Work Opportunities Workshop
1:00 p.m. - 4:00 p.m., Career Centre Seminar Room

December

1 Tuesday

Graduating Students Employment Orientation
3:00 p.m., Career Centre Seminar Room

2 Wednesday

Recent Graduates Employment Orientation
2:00 p.m., Career Centre Seminar Room

7 Monday

Graduating Students Employment Orientation
3:00 p.m., Career Centre Seminar Room

8 Tuesday

How to Look for Summer Work Seminar
2:00 p.m. - 4:00 p.m., Career Centre Seminar Room

Recent Graduates Employment Orientation
6:00 p.m., Career Centre Seminar Room

10 Thursday

Recent Graduates Employment Orientation
10:00 a.m., Career Centre Seminar Room

14 Monday

Exams Begin

16 Wednesday

Recent Graduates Employment Orientation
10:00 a.m., Career Centre Seminar Room

23 Wednesday

Career Centre Closed until Monday, January 4, 1999

Resources in the Engineering Career Office:

These resources may be signed out overnight. You must complete the "Resource Sign-Out" form and leave one piece of identification at the Engineering Career Office.

BIOMEDICAL ENGINEERING:

- Canadian Biotechnology 1998-hardcopy, CD-ROM & Internet Publication
- The Greater Toronto Medical Industry Guide 1996
- The Canadian Medical and Biological Engineering Society newsletter and membership information

CHEMICAL ENGINEERING:

- Top 95 Companies In Calgary
- 1996 Salary Survey, American Institute of Chemical Engineers
- Canadian Plastics Machinery & Moulds Directory (Canadian Plastics Industry Association)
- Canadian Plastics: Plast-Ex 98, Exhibitors Profile and Directory
- Canadian Society for Chemical Engineering Company Directory and membership information
- Financial Post Top 500 and Next 300 Companies By Revenue (Calgary)

CIVIL ENGINEERING:

- Canadian Institute of Transportation Engineers
- Career Brochure
- Membership Directory
- Newsletter
- Resource Guide
- Canadian Urban Transit Association
- Construction Industry Membership Directory and Buyers Guide, 1996-1997
- Design Magazine
- The Journal of the Ontario Association of Architects
- A Career as an Architect

COMPUTER ELECTRICAL/ ELECTRONICS ENGINEERING:

- CACEE WorkWeb- Jobs Abound for I.T. Students
- Toronto Computers Newspaper
- IEEE- Professional Awareness Guide, A Resource for your Future
- Ottawa Technology Industry Guide- June 1998

ENVIRONMENTAL ENGINEERING:

- International Environmental Youth Corps Information Package
- Ontario Centre for Environmental Technologies- Company Profiles

GEOLOGICAL ENGINEERING:

- Opportunities For a Career in Mining and Metallurgy
- Canadian Geotechnical Society Information package

METALLURGY AND MATERIALS SCIENCE:

- ASM International-The Materials Information Society Ontario Chapter 1997-1998, Yearbook Membership Directory and Buyer's Guide

MECHANICAL & INDUSTRIAL ENGINEERING:

- APMA- Auto Parts Manufacturers Association-High-Tech Manufacturing Careers in Canada
- ASHRAE-American Society of Heating, Refrigeration and Air-Conditioning career profiles and membership information
- Canadian Plastics: Plast-Ex 98, Exhibitors Profile and Directory
- Manufacturing and Process Automation Newspaper –Sept 1997 to present

CAREER DIRECTORIES/ BUSINESS DIRECTORIES:

- Advanced Technology Companies In Metropolitan Toronto & Region, 1997
- Association of Consulting Engineers of Canada-CD ROM
- The Canadian Job Directory
- The Career Directory, 1998 Edition
- The 1997 Canada Student Employment Guide
- Electronic Job Search Almanac
- Reference Directory of Business Directories in the Metro Reference Library
- Sources of Information for a Job Search
- The Toronto Region Top Employers Guide 1998

BUSINESS DIRECTORIES/ OPPORTUNITIES OUTSIDE THE GREATER TORONTO AREA:

- Calgary's Top 95 Companies Ranked by 1996 Revenue
- Financial Post Top 500 and Next 300 Companies By Revenue (Calgary)
- Ottawa Technology Guide- June 1998

INTERNATIONAL CAREER DIRECTORIES:

- Contact Singapore Information Package
- Disco International Career Resources
- International Casebook, 1998- Careers in South East Asia
- Ward Associates- USA & Canada, It's a Two Way Street
- What in the World is Going On?-A resource for students interested in Career Opportunities Outside Canada

NEWSLETTERS:

- KPMG-The Human Edge- September 1997 to present
- Professional Engineers Ontario-The Mentor
- Professional Engineers Ontario-The Link
- Silicon Valley North-September 1997 to present
- Wet Feet Press- Electronic Insider January 1998 to present

NEGOTIATING/ COMPENSATION GUIDES:

- CACEE Web-How do I chose which offer to accept?
- Professional Engineers Ontario
- Overall Salary Survey Results on disk
- Survey of Employers-Consulting Services
- Computers
- Electrical/ Electronics
- Petrochemical/ Chemical Products
- Primary Metals/ Metal Fabrication
- Wet feet Press- So, You Have a Job Offer: The Essential Compensation Negotiation Guide

INSIDER REPORTS- HIGH TECHNOLOGY:

- Hewlett-Packard Company
- Intel Corporation
- Intuit Inc.
- Microsoft Corp
- Oracle Corporation
- Silicon Graphics Inc.

INSIDER REPORTS- MARKETING:

- So, You Want To Be a Brand Manager
- Procter & Gamble

INSIDER REPORTS- INVESTMENT BANKING:

- Career Opportunities in Investment Finance, Investment Dealers Association of Canada
- Wet Feet Press Electronic Insider
- So, You Want To Be an Investment Banker
- Capital One
- Citibank
- Goldman, Sachs & Company
- J.P Morgan
- Lehman Brothers
- Merrill Lynch
- Morgan Stanley Dean Witter
- Salomon Brothers
- Smith Barney
- Toronto-Dominion
- 1999 Harvard Business School Career Guide- Finance
- 7 Steps to a Job in Investment Banking
- One Month in the Career of an Investment Banker

INSIDER REPORTS- MANAGEMENT CONSULTING:

- Wet Feet Press Electronic Insider
- Andersen Consulting
- Bain & Company
- The Boston Consulting Group
- Coopers & Lybrand
- Deloitte & Touche Consulting Group
- Ernst & Young
- KPMG Peat Marwick
- McKinsey & Co.
- Mercer Management Consulting
- Monitor Company
- Price Waterhouse
- Harvard Business School Career Guide-Management Consulting
- Killer Consulting Resumes
- Ace your Case
- 15 Questions- More Practise to help you Ace your Consulting Case
- The Wharton MBA Case Interviews Study Guide 1997-1998

Volunteers needed!

Pierre Duez
ENG SCI 0T0

Throughout the year, the Engineering High School Liaison committee hosts a number of events for high school students, to give them an idea of what it's like in Engineering. F!rosh-for-a-day is one of these key events.

F!rosh-for-a-day is on the 13th and 20th of November. Students from high schools across Ontario visit UofT campus for the day. They listen to student talks about academic and social life in Engineering; they participate in miniature design projects; and they get led on tours of the Engineering buildings and campus as a whole.

This year, F!rosh-for-a-day is expected to draw a total of 250 students from throughout the province. The organizers, Glenn Hauck (Eng Sci 0T1) and Monika Go (Eng Sci 0T0) have been busy co-ordinating with schools and planning activities, but their busiest days are yet to come.

F!rosh-for-a-day is fast approaching and High School Liaison needs your help: if you want to help with this event on either day please let High School Liaison know via email to imagine@ecf. Volunteers will receive free lunch, and the gratitude of a plethora of high school students.

Other liaison activities through the year include: UofT Day (early October); Campus Tours (Thursdays and Fridays throughout the school year); March Break tours (in March, understandably); and Skule Daze (May).

There will be an important meeting concerning F!rosh-for-a-day on Wednesday November 11 at 5pm in room GB405.

Chess, Anyone?

Pierre Duez
ENG SCI 0T0

The annual Engineering Chess Challenge is back! Hosted by the Division of Engineering Science, this event features Professor Vranesic, the Eng Sci division chair (and former Chess Grandmaster), and pits him against all who are willing to compete.

The structure of the challenge is simple: a ring of tables, each with Chess boards. All contestants are playing against professor Vranesic at once, as he makes the rounds and makes one move per board.

Do you think you have the skill to challenge Prof. Vranesic? (Do you simply want to have a good time?) Then come on out to the Engineering Chess Challenge to try your skill.

A few points to remember, if you want to compete in the Challenge:

- you must bring your own board and pieces
- your pieces have to be close to "standard," so that they can easily be recognized by Professor Vranesic. (This decision is up to the professor to make.)
- the number of contestants is limited by the amount of space available

The Chess Challenge will take place in the third week of November, in the Sandford Fleming Atrium. All contestants (Engineers or non-) are welcome to watch or participate.

For more information, contact Pierre Duez (duez@ecf).

Club Reports

Club Profile

Pierre Duez
Eng Sci Club Secretary

Pierre was born and raised in Toronto, though he spent most of his childhood weekends at the family farm near Collingwood. He went to elementary school at École publique Gabrielle Roy (a French school in downtown Toronto) and went to high-school at the University of Toronto Schools (UTS).

Currently in his third year in Eng Sci, Pierre is in the Computer stream. Aside from his duties as Secretary of Eng Sci club, Pierre also volunteers his time with the Cannon as Club Editor [Ed. Note - ever wonder why this was the first biography to be included?], as well as with his high-school as a Director of the Alumni Association.

Pierre's hobbies include computers, volleyball, computers and friends. (and computers, of course). He can most often be found in the Eng Sci common room, and is always willing to help in whatever way possible.

Within Engineering, Pierre is also very involved in High School Liaison activities. *He has helped at U of T day for the past* three years; was a Leedur at SkuleDaze98, and has helped with F!rosh-for-a-day for the past two years.

Though he often complains about having "too much on [his] plate," Pierre admits that he would not want to give up any of his activities, even if it allowed him to unburdening his busy schedule.

As Secretary of Eng Sci club, Pierre is responsible for advertising upcoming events (such as smokers and the Dinner Dance [Ed. Note: November 21st!!!]), assisting with Dinner Dance ticket sales and basically "filling in" wherever he's needed.

Eng. Sci. Smoker Update

Pierre Duez
ENG SCI 0T0

Another month has gone by, and with it, another smoker. Eng Sci club held its MSE/Hallowe'en smoker on the 29th of October, and it was a success! Prof. Park came and spoke to students about what Manufacturing Systems Engineering is; there were festive decorations and Hallowe'en costumes in - well, not in abundance, but there were a few visible.

Fortune telling, apple-chasing, and a bit of organ music to top it all off... what more could one ask for?

The next smoker is the Aerospace Trivia smoker, to be held on Thursday November 12th, starting at 4 p.m., in the Eng Sci common room. We hope to see you all there!

Chem Club

Katherine Wong and Kim Krieber
CHEM 0T0

Can it be November already? Hopefully everyone has passed their midterms with flying colours. I guess you are all ready to celebrate and party down, too. So clear your schedule for November 24th, 1998 because the Annual Chemical Engineering Dinner Dance will be happening and everyone is invited. The tickets cost only $35 and this event gives you the chance to mix and mingle with your fellow "soon-to-be" chemical engineers.

Other events happening this month include: the ongoing Fantasy NHL Pool, a Gitoni Tournament and Monthly Smoker (TBA). We would also like to congratulate all those who participated in dressing up for the Hallowe'en Smoker. Costumes spotted included: a beautiful genie, Snoopy, a bright crayon and a sheik. The smoker was a hit, with great music, henna body art, various shooters and cheap but delicious food. Thanks to all the participants for showing their Hallowe'en spirit. We hope to see you all at the Christmas Smoker next month.

Mec Club

Shirlie Ho
MEC 0T0

Well, we hope you have made it through your midterms without too much stress and anguish. In the near future, the Mech/Indy Semiformal will be a great opportunity to release all that stress by eating great food and dancing the night away. The Semiformal will take place on Friday, November 20 at the Great Hall. You can purchase your ticket this week for only $28 from your Mechanical or Industrial Club Representative. In the meantime, don't get too stressed over exams, yet. If you have any suggestions for the Mech Club, feel free to contact your Mech Club Representative or any of the following people:

Co-Chair Engy Khalil
Co-Chair Anjan Nayani
Vice-Chair Shirlie Ho
Treasurer Ghassan Sleiman
Secretary Michael Bonert

Dinner-Dance Info

We're the PEY Club co-chairs for this year. The PEY Club is the liason between PEY Students, the PEY Office and the Engineering Society; all past and present PEY participants are members! So if you have any questions or concerns about school or skule(TM) events, feel free to ask us!

If you know anybody on PEY that did not get this mail, or would like to change their contact e-mail address, please ask them to send a note to peyclub@ecf.utoronto.ca. We will be sending out information on various skule(TM) events, and more importantly, details on registration for next year and thesis/design project information for the 4th years. So make sure we have your current address if you want to keep in touch this year!

Now for our first announcement— the dinner-dances for each engineering discipline are happening soon; here are the details:

ELECTRICAL/COMPUTER
Saturday, Nov. 7
Colony Hotel
Tickets - $35; on sale until Nov. 4
Contact - stephen@ecf.utoronto.ca

MECHANICAL/INDUSTRIAL
Friday, Nov. 20
Great Hall (Queen St.)
Ticket price TBD
Contacts - nagani@ecf.utoronto.ca
margaret@mie.utoronto.ca

CIVIL
Friday, Nov. 20
Fantasy Farm
Tickets - $50, Open Bar (limited number of tickets)
Contact - civclub@ecf.utoronto.ca

ENGINEERING SCIENCE
Saturday Nov. 21
Great Hall
Tickets - $40
Contact - moncrie@ecf.utoronto.ca

CHEMICAL
Saturday Nov. 28
Primrose Hotel
Tickets - $35-40
Contact - hochris@ecf.utoronto.ca

MATERIALS/MMS
January date TBD

Geological will not be holding a dinner-dance.

The contact for each discipline should be able to help you make arrangments to buy tickets. If you have any other problems, please let us know and we'll see what we can do!

For the PEY students that are not in Engineering, please tell us if there's any information that you'd like us to find for you (PEY has traditionally been mostly Engineering students, so we're not sure what you guys want us to do!).

Thanks!

The Professional Experience Year (P.E.Y.) Club
University of Toronto
Club Co-Chairs:
Jennifer Park,
Jennifer Stephenson
peyclub@ecf.utoronto.ca

Next generation of spacecraft is for the average Joe and Mary

Gloria Chang

Ready for a ride into space?

Forty-one years after the original space race began with the launch of the Russian Sputnik, the world's first orbiting satellite, a new race has emerged. But this one doesn't pit the West against the East in Cold War animosities. Rather, its goal is to make space flight accessible to the average Joe or Mary – by offering a $10 million (U.S.) cash prize to the first person to design a spaceship that can take three passengers into space and back.

"It will do for space flight what PCs did for computers – take it out of the realm of governments and very large corporations and put it in the hands of average folks," says Greg Maryniak, CEO of the X Prize Foundation, a St. Louis-based, non-profit organization that's putting up the X Prize money.

The space industry is hoping that $10 million cash and international recognition will stimulate innovative spacecraft designs.

The biggest obstacle to opening up space flight is money, says Maryniak. "It's too expensive." Since the beginning of the space age, the cost of space flight hasn't changed much, he says, and that's because there hasn't been enough flights to force the cost down.

So, in an effort to stimulate innovative, less expensive spaceship designs, the foundation has come up with an international competition that taps into the public's fascination with all things space-related. Ten million dollars will go to the first privately-funded person or team that designs a spaceship capable of launching three passengers to a suborbital altitude of 100 km – what's considered to be the beginning of space – on two flights in as many weeks. At that altitude, passengers would get to experience about four minutes of weightlessness and get a view of the curvature of the Earth, much like what American astronaut Alan Shepard experienced when a Redstone Rocket took him and his Freedom 7 Mercury capsule on a 15-minute suborbital flight back in 1961.

Spacecraft must be capable of carrying three passengers into suborbital flight twice in two weeks.

The emphasis of the competition is on the spaceship's reusability, an ideal that was not quite reached by the current NASA space shuttle which was supposed to be the first fully reusable spacecraft. Its fuel tanks are tossed in midflight as are its rocket boosters which are partially reusable. The reusability of this next wave of spacecraft will help develop commercial markets, which for this group, is believed to be space tourism. The industry already takes in about $1 billion a year in space museum visits, space camps and zero-gravity trips in aircraft. According to a joint study by NASA and the Space Transportation Association, there's a potential to multiply that space tourism business from $1 billion to $10 or $20 billion per year.

"Once the cost of putting something into space goes down, the number of things you can afford to do goes up dramatically," says Maryniak, who believes that once the space tourism industry is booming, the next market to develop is rapid package delivery followed by rapid passenger transport. And there's a precedence, says Maryniak.

"In the early days of aviation, the first real commercial business – before passenger service, before air mail – was people who wanted to take a ride to see what it felt like to fly like a bird."

The X Prize Competition is modeled after the Orteig Prize won by Charles Lindbergh for his non-stop flight from New York to Paris in 1927.

The X Prize competition itself is actually modeled on the Orteig International Prize of 1927, which spurred Charles Lindbergh's famous non-stop flight from New York to Paris 71 years ago on the Spirit of St. Louis – so named because the aircraft was financed in large part by men in the city. The $25,000 cash prize stimulated nine attempts to cross the Atlantic and the investment of $400,000 in aeronautic design. The prize was one of over 100 aviation prizes offered between 1905 and 1935, which created today's $250 billion aeronautics industry, says Maryniak. So, in an effort to repeat history, after the X Prize is awarded, the foundation plans to offer an annual $25,000 X Prize New Spirit of St. Louis Award to individuals who've made the greatest contributions to commercial human space flight.

The cash prize and international recognition aren't the only things emulating the aeronautics industry. Many of the 15 competitors' designs utilize airplane technology.

Called spaceplanes, these vehicles are equipped with both jet and rocket engines. While the jet engines are used during takeoffs and landings, the rocket engines launch the spaceplanes into space. This allows them to be handled more like aircraft, which entails far less expensive maintenance and operational costs than rocket launches using a conventional launch gantry.

The X Prize Foundation is hoping to make space flight a family-oriented trip.

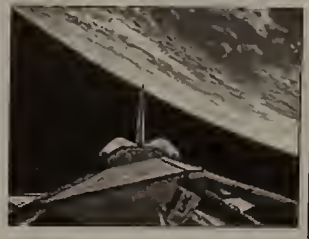
"If you take off or land at a runway instead of using a launch gantry, you save a lot of facility costs, infrastructure investment," explains Mike Scardera, senior systems engineer at Pioneer Rocketplane, a company entering a spaceplane called Pathfinder that will fill up with rocket fuel in midflight from a flying tanker.

Others avoid the operational costs associated with typical rocket launches by launching their spaceships from an aircraft in the air. The Eclipse Astroliner, entered by Kelly Space Transportation, will be towed into the air by a 747 jet which acts as its propulsion system. At an altitude of 20,000 feet, it fires up its rocket engines to make its way into space. Once back down to 20,000 feet altitude, it starts its jet engines for its descent onto a runway.

Burt Rutan's Proteus aircraft would carry a shuttle under its fuselage and launch it into space from the air. CLICK to hear Rutan talk about it.

Burt Rutan of Scaled Composites has entered an as-yet-unnamed shuttle that will be launched from an aircraft he designed to carry large payloads below its fuselage.

Another spaceship, called Mayflower, doesn't use jet engines, but it does avoid the typical rocket launch costs by taking off from the ocean!

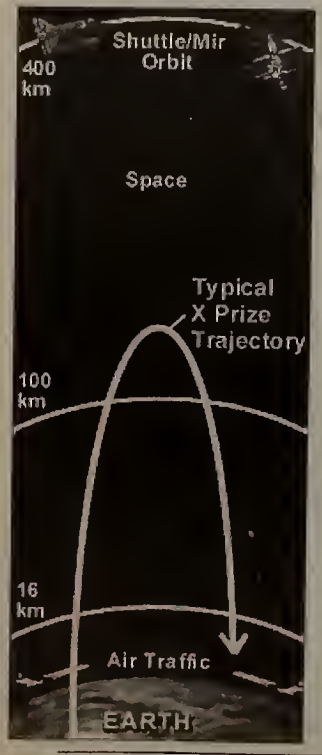


At an altitude of 100 km, a passenger on an X Prize flight would see the curvature of the Earth. Here is the view from the shuttle.

It's a new era of spacecraft design, in which spaceships can be treated more like aircraft and the passengers won't be professional astronauts, but adventure seekers or space enthusiasts. Space tourism companies are already signing up more risk-seeking passengers for the first flights at $5,000 to $6,000 U.S. per flight.

"We want to convert peoples' thoughts on space flight from something only governments can do to something that we [private industry] can do," says Maryniak.

To see the spaceship designs entered in the X Prize Competition, see EXN's slideshow Next Generation of Spacecraft.



Wipe of the Nose

EXN Staff

This could be more than it might seem. The inner workings of the human body are a marvel at the best of times. But sometimes they're also a mystery. That's exactly the case with some new research by neurologists in Austria. The scientists have found what appears to be a strong correlation between certain seizures in the brain and an unconscious response of the epileptic patient to wipe their nose.

Dr. Christoph Baumgartner, lead author of the study and neurologist with the University Clinic of Vienna, found that simply observing certain epilepsy patients can help in determining where a seizure originates in the brain. And it really does come down to a wipe of the nose.

Baumgartner and his team studied 101 patients with 'difficult-to-treat' seizures confined to one region of the brain. In an epilepsy-monitoring unit for pre-surgical evaluation, however, video cameras caught something on tape something no one had really noticed before. In the 440 seizures caught on tape, researchers found that a large proportion of individuals wiped their noses afterward.

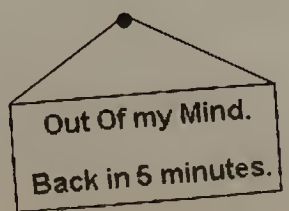
In fact, the behaviour was observed in 39 of 76 patients with temporal lobe epilepsy – the most common type of seizure confined to a specific area of the brain. Such a seizure can result in a variety of symptoms ranging from a sudden loss of responsiveness and unprovoked sense of fear to déjà vu or lip-smacking movements. Three out of 25 patients with extra-temporal lobe epilepsy also exhibited the behaviour.

Post-seizure nose wiping, as it's called, was also found to be more frequent in patients with temporal lobe epilepsy originating on the right side instead of the left.

"This simple gesture, nose wiping, accurately identified which side of the brain, and location within the brain [that] the seizures originated – in 97 per cent of patients who wiped their noses," remarked Baumgartner. "Surprisingly, the hand a person uses to wipe his or her nose correlates with the same side of the body a seizure originates."

In a general sense, wiping one's nose is a response to an increased amount of fluids in the nasal passage. In the case of epileptic seizures, this is often the case during or after seizures in the brain's temporal lobe. Coughing and producing extra saliva are also common following such a seizure.

Baumgartner says this newly observed nose-wiping phenomenon could be used as another diagnostic tool for surgeons – in addition to brain images and tests – to determine where such seizures originate. And when it comes to surgery involving the brain, the more information a surgeon has, the better the outcome will likely be.



Professor Profiles

George Will

Vera Kan
CIV 9T9 + PEY

I first met Professor Will in my 1st year statics course three years ago. First impressions certainly linger! As noisy but impressionable young f!rosh, we were instantly silenced with a stern look from Prof. Will. This was a fellow trained in the old Red Skulehouse, and he taught the way his predecessors in that vanished building did. No drinking, eating, or talking in Will's class! Nor do I think anyone from my F!rosh A Group was late for CIV 100F after the first week of classes.

Still, time passes and even Professor Will is now enjoying his retirement from teaching, administering and researching in the Faculty of Applied Science and Engineering. In the short span between my first year and this year I had gotten to know Professor Will better, and classmates who went for help in statics found him to be approachable, friendly and certainly helpful, so much that he has won four teaching awards in his career. So it was with pleasure that I sat down with Professor Will on a Monday afternoon in early Octoher to recount some of his good times with the Faculty, his retirement now, and what he foresees in the future.

HIS UNDERGRADUATE YEARS:

Like many of the engineering students today, Professor Will was a commuting student in his undergraduate years as he lived at home in Scarborough in the area of Midland Avenue and Kingston Road. It took him an hour to get to school, taking the Kingston Road bus, to the Danforth streetcar line (the Bloor subway extensions had not yet heen built) and then on to the university. The "Little Red Schoolhouse" was still standing at the time of Prof. Will's education, a benchmark of how different the style of instruction was.

While engineering is a busy field of study today, in Prof. Will's time, there were even more contact. "Every day ran from 9:00 am to 5:00 pm," Will recalls, "and there were 11 to 13 full year courses" (as opposed to the two-term system we enjoy today). There were few or no Christmas exams, hut by April, students would be reviewing material from as far back as September for those courses, and most exams counted for 100% of the course marks.

Students found out if they passed or failed a year by seeing the pass lists published in newspaper, (either in the Globe and Mail, or the Evening Star, forerunner to the Toronto Star) -the absence of your name usually meant that you had failed the year! At the end of fourth year every student would receive a book in place of transcripts, which recorded every student's mark in every course since 1st year. These have since been discontinued, but a copy can be found in Robarts Library, possibly one with Professor Will's own record!

Outside of academics there were plenty of activities for students to engage in. Prof. Will himself played lacrosse in his third and fourth year-he was too worried about passing his first and second years!

INSPIRATIONAL PROFESSORS:

There were fewer T.A.'s in the 1950s to help professors with their teaching duties, so professors prior to 1960 tended to teach more and research less. Prof. Will recalls Professor Huggins to be an especially strong professor who influenced many students to enter academia, including himself. Huggins taught five courses, (dynamics, solid mechanics, applied elasticity, structural design and reinforced concrete) over Will's four years as an undergrad. Will fondly describes him as "a nice man, a good engineer and a very good teacher."

Other notable professors of the time included Professors Marshall (experienced with surveying after working on the Tennessee Valley project,) Macklin (also a surveying prof,) Hershfield (who primarily taught the architecture students,) and Morrison (who instructed Prof. Will in statics.) These professors later went on to start engineering firms that bear their names, and continue to operate today.

On breaking the tough news of failing, he feels that "if you explain things in a decent way, the students will understand."

DRAFTING, SURVEYING, AND SUMMER JOBS:

Prof. Will attributes the high number of contact hours to the amount of drafting the students were required to do at the time. In fact, drafting figured so prominently in Prof. Will's memory that "it seemed we were drafting every day!" There were drafting classes through all four years (compare that with a single course in 2nd year for the civs!) and the whole of the fourth floor of the Galbraith Building was composed of drafting rooms. (These rooms often acted as "homeroom" for students, where they had a desk assigned to them, and it frequently acted as a lunchroom as well.) Perfecting one's technique in drafting was a long slow process, but by the end of third year, Prof. Will had become sufficiently proficient to get a job with Dominion Bridge for the summer.

Surveying was another subject that figures less prominently today, but was absolutely essential for getting that first summer job in the 1950s. Every 1st year student, (mechs, elecs, as well as civs) would take drafting and surveying so that they would have some employable skills. So like very many other students, Professor Will worked on surveying teams with Scarborough Township, Roads Department after his 1st and 2nd years. In fact, he learned surveying with the very same transits from the 1940s that civil engineering students in the 1990s are using today!

ON BECOMING A PROFESSOR:

Professor Will is one of those few profs without a Ph.D, but attained professorial status by "working his way through the system". A glance at his academic appointments sees a progression from a lab demonstrator to full professor. It was a tough road. While graduate students are restricted to only 10 hours of paid employment today, Will and Timusk had at least 21 contact hours with students, plus extra time for marking and preparation on top of their own studies. However, running a whole gamut of teaching positions prepared them well for the teaching side of their careers.

Since the emphasis on research and Ph.D's appeared only after the 1960s (there were no Ph.D students prior to that time,) Will credits his three years with MIT as being absolutely essential to being promoted to professorial status. There, he learned the finite element theory under its prime developers. The finite element theory was a new and exciting development, and has become the basis for most structural analysis programs.

HIS ADMINISTRATIVE CAREER:

Professor Will doesn't think that he could handled forty years of design work in industry, so the variety found in academic life proved to be a boon. He served as Associate Chair for the Department of Civil Engineering, and Associate Dean for the Faculty. His prime job in both positions was to counsel students. On breaking the tough news of failing, he feels that "if you explain things in a decent way, the students will understand." It was a heavy job, but he enjoyed helping the kids, developing a good rapport with students. He also handled problems between staff and students, sometimes assuming the role of disciplinarian, but generally they were the "good times" in the Dean's office.

ON TEACHING:

Teaching was the preferred part of Will's job. "While research was fun, it wasn't my greatest strength...teaching gave me more kicks," Will says, "and it was never boring teaching the same subject because every class is different." He especially relished 1st year statics, with students fresh from high school. He is proud of his teaching awards, but especially the one he received from the CIV 9T8 class. Things from students are what Will really enjoys, and he had no idea what awaited him at the 1997 CIV department dinner until he spotted two of his kids in attenance. Professor Soberman and the club chair "roasted" Will with a commentary and a slide show that in retrospect, I wish I hadn't missed!

HIS RETIREMENT:

Professor Will's three children are all grown up (aged 36, 29 and 27) and his retirement now consists of doing "absolutely nothing". He putters around the house, bikes, walks, but there are no particular activities or organizations he has tied himself too. Delightedly, he says, "it's like a holiday, but better because I don't have something to go back to!" While energetic, he isn't looking for a second career yet. He remains an advisor to the solar car race team, but has no regrets about otherwise cutting his ties to the university.

As noisy but impressionable young f!rosh, we were instantly silenced with a stern look from Prof. Will.

ON THE FUTURE OF ENGINEERING EDUCATION:

To Will, the problems students face today are not greatly different from those of his own time. While tuition has gone up since his Skuletm days, so has the average income. The big difference however, is that most students in the 1950s lived at home, and there were very few out-of-town students. Every student could make enough money in the summer for tuition, and living at home meant the parents had borne that side of the expenses. (Few could make enough over a summer to also pay for residence or off-campus housing.) And unlike today, getting a well-paying summer job was never a problem.

Still, with all the hue and cry of change, Prof. Will doesn't expect engineering, or the university, to change radically and very fast. There are simply too many people built into the system, and any changes made will tend to be incremental. For example, setting up and expanding the ECE department was a tough, slow job of gathering money, profs and facilities.

Prof. Will also doesn't feel that there is a overly strong commercializing of the university, and he himself has experienced few problems. He recognizes a strong need for money in the university, and with cutbacks in the public sector, contracts with the private sector are the only other alternative at this time. The university system could slowly go back to the system of the 1950s, with fewer staff, no electives, but it is more likely that, like Halifax's universities, each school will concentrate on their strengths and have with less duplication.

Professor Will is no longer in a position to guide the department and the faculty through the times ahead, but I am certain that he will remain a keen observer. We wish him the best in his retirement years.